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The Efficiency of Generation

THE cost of fuel forms nearly two-thirds of the works cost of generation, and is the only factor of the total expenditure on electricity supply that varies substantially with output. Thus every kWh sold must bear its share of fuel charges, whether used on or off peak.

The most convenient way of gauging power-station performance is by overall thermal efficiency, and the returns of fuel consumption (which we review in this issue) prepared annually by the Electricity Commissioners is probably the most eagerly awaited of their publications, since, apart from the broader issues involved, it decides the merit of each station and appears soon enough after the period to which it relates to be of immediate interest.

Each year sees a new record set up. In the returns for 1934, Barking B. gained first place with 27.95 per cent. But it has not been allowed to keep it, in spite of an improvement to over 28 per cent. in 1935, as Battersea has now taken the premier position with 28.59 per cent.—a figure that until recently few would have expected to be practicable over a twelvemonth's working period. Battersea, too, has the distinction of being the first station to generate at less than one pound of coal per kWh.

Waiting its chance is the Dunston 50-cycle station, which has done well to achieve 27.25 per cent. under the handicap of matching its loading with the frequency-change programme of the North-East Coast; at this figure it is well above even the high level reached by Clarence Dock only two years earlier.

Turning to conditions of generation as a whole, the average fuel consumption per kWh for all stations is little more than three-quarters of what it was for 1929-30, which we then noted as the first occasion on which the average for the country had fallen below 2lb. Even the relatively small improvement in fuel economy over 1934 is equivalent to the production of nearly 600 million kWh free of cost.

Much of the advance in recent years has no doubt been due to the closing of the less efficient stations, as last year in the areas in which the Central Electricity Board was operating 148 selected and temporarily selected stations sent out all but 5 per cent. of the total generated by authorised undertakings; only twenty-eight of these worked all the time and fifteen supplied more than half of the output. As over thirty stations last year had thermal efficiencies above 20 per cent. (compared with eight six years ago) there is evidently considerable scope for flexibility in working.

Apart from methods of running the stations, some increase in operating skill is to be expected, as the newer conditions become better understood, but a great part of the credit must be attributed to improvements in design, as it is the newer plant which tends to give the best results. Progress at the same rate cannot, however, go on much longer without radical departure from existing practice. Perhaps the high-pressure plant at Brimsdown A. may break new ground or the raising of turbine speeds to 3,000 r.p.m. in larger capacities than at present. Every fractional economy is well worth while, since, as a general rule, technical efficiency in generation is the same as "dollar" efficiency.

Protecting Key Industries

THE special duties imposed in 1921 as a means of fostering the development of certain "key" industries have been fully justified by events, according to the report of the Board of Trade Committee appointed to consider the position arising upon the expiry of the term of the duties in August next. Research has been encouraged and has been fruitful of results, while prices do not appear to have been raised unduly. In 1926 the duties were renewed for a period of ten years. The Committee recommended that they should be continued for a further ten years, and it also proposed that parts of arc-lamp carbons and parts of radio valves, rectifiers and vacuum

tubes should be brought within the scope of the duties. It appears that there has been considerable evasion by importers, *e.g.*, carbon shells and cores have been imported separately and assembled here. Hitherto exemptions from the duties have been by General Order. The Committee considered that a system of licences for individual consignments, as under the Import Duties Act, would be preferable. In presenting his Budget on Tuesday, the Chancellor of the Exchequer announced that the Government had decided to adopt the Committee's recommendations.

Technical Summer Schools

THE mental stimulus provided by visits to large manufacturing works is probably of equal value to the practical information to be acquired from detailed examination of the new developments that are produced in such places. Both are especially necessary to those concerned with the academic instruction of students, who are only too quick to depreciate the value of theory if it is not closely in accord with the latest practice. The second summer school arranged by Mr. A. P. M. Fleming at Trafford Park this week for the purpose of bringing together those responsible for the technical education and for the practical training and future employment of young engineers once more met with well-merited appreciation, as it has been attended by upwards of 180 representatives of sixty colleges and educational authorities and included several members of Dominion Universities. Although the Met-Vick Co., which has under training about 800 trade and 300 college apprentices, is normally in close touch with the universities, a further strengthening of the tie on these lines is likely to commend itself to those interested in the future of the industry.

Forthcoming Electrical Functions

WHILE our "Forthcoming Events" section gives details of most functions of electrical interest during the next week, for those who wish to enter up their diaries well in advance the latest list compiled by the I.E.E., covering a period of over a year, offers much useful information. In May there are more than a dozen events, including the annual conferences of the E.A.W. (13th to 15th) and the Institute of Transport (20th to 23rd). June, of course, provides the I.M.E.A. Convention at Edinburgh (8th to 13th), while there are also the I.E.E. summer meeting in Scotland (15th to 20th), the E.C.A. Conference (week commencing 22nd), and the World Power Conference (22nd to 27th). July brings the I.E.E. Annual Conversazione (2nd) and that for overseas members (15th), while in August the Electrical Industries Benevolent Association has arranged a cruise on the T.S.S. *Vandyck* (August 22nd to September 4th). Rather too far off for the majority of us, but of interest all the same, are the Third World Power Conference at Washington (September 7th to 12th) and the International Meeting of Naval Architects and Marine Engineers (September 14th to 19th) in New York. In October the chief event is probably the National Smoke Abatement Society Conference (14th to 17th), and then the winter season starts in earnest with its crop of social functions.

The Example of Oxford

IN his I.E.E. paper on tariffs earlier in the month Professor Miles Walker cited the Oxford undertaking as an example of the influence of low prices on rapid development following a change in control. The effect of early legislation on the maintenance of high prices by Provisional Order companies in many cases need not be considered here. What is of importance is the way in which full advantage is being taken of the new position by the municipality with its security of tenure, and the result of this policy is indicated in the article which we publish this week. To treble the output within four years is not, however, merely a matter of reducing charges drastically; it entails also the laying out of a distribution system having a capacity and flexibility to deal with an increased demand for many years ahead, as Mr. H. G. Fraser, the city electrical engineer and manager, evidently does not expect electrical saturation, despite the progress made to date. In addition to this, a comprehensive public-lighting conversion is in hand, in connection with which we share Mr. Fraser's expectations regarding the future of discharge lamps. While the courage to reduce prices from almost the highest in the country, to use Professor Miles Walker's expression, to almost the lowest for that kind of district, is not the only factor involved, as it does not give full weight to the all-important personal aspect, the Oxford undertaking does provide a striking instance of the economic justification of reasonable tariffs.

Cable Development

THE progress reviews included from time to time in the *Journal* of the I.E.E. provide an excellent means of co-ordinating for the benefit of its members important developments in the electrical industry. The most recent, by Messrs. C. F. Bolton and R. H. Abell, relating to transmission and distribution (of which we present an abstract in this issue), covers a wide field from which an indication of tendencies may be deduced. Thus, the proved reliability of the oil-filled cable, coupled with the possibility of using underground pressure-feed oil tanks and of manufacturing the three-core type up to the highest voltages in use in this country, should ensure its more widely extended use, even in face of the success achieved with gas-pressure designs in which dielectric stress can be doubled. Not less important is the reduction in the thickness of paper dielectric and the raising of the maximum temperatures permissible with 11-kV cables. These developments should greatly expand their scope for secondary transmission in rural areas, where small reductions in the cost of the cable itself become of greater moment as the cost of excavation is lowered.

Machinery Exports Higher

IT is heartening to find that, with foreign competition as severe as it is to-day, and notwithstanding the unsettled situation abroad, which continues to hamper international trade, the value of exports of British electrical machinery is on the increase. In January it was £387,813; in February, £422,232; and in March, £455,427. The amount shipped overseas last month was 51 per cent. more than in the corresponding period of 1935, and, excluding generators and motors, the expansion was no less than 72 per cent. The bulk went to various parts of the Empire. In the quarter just ended the value of machinery leaving this country for British India was £86,000 more than in the first quarter of last year, while £65,000 more went to Australia and £18,000 more to South Africa. Three times as much machinery (excluding motors and generators) was dispatched to Malaya and nearly twice as much to New Zealand. Electricity still has a good deal of headway to make in these countries, and there is no reason why they should not continue to provide increasingly profitable markets for our manufacturers for a long time yet.

Speeding up Connections

WHAT kind of an effort is needed to secure a million new consumers in a year? Manchester Corporation mains department has for the past few months been laying house services at the rate of one in just over seven minutes of normal working time. If all the supply undertakings in the country were equally busy and kept it up throughout the year, the total number of new connections at the end of 1936 would be one-fifth in excess of the figure aimed at by E.D.A. So far as arithmetic goes, it would appear that undertakings which slip in a service cable every eight and a half minutes as an average are pulling their weight.

Load Building at Oxford

The influence of the colleges

IN the matter of electricity supply (and use) Oxford differs from most other cities, mainly because of the colleges and schools and the city's unusual building development. During a recent visit to Oxford we were told by Mr. H. G. Fraser, M.I.E.E., city electrical engineer and manager, that there is considerable scope for extending the use of electricity in the colleges, chiefly for cooking in the central kitchens and for heating in the undergraduates' rooms. Most of the cooking is still done by open fires, but the Electricity Department is seriously tackling the problem. Already three colleges and one hall have been converted to electric cooking, while, following continuous propaganda, special efforts are to be made to influence the college authorities as and when their kitchens become due for reorganisation.

An idea of the electrical development at the colleges is conveyed by the following statistics. For the thirty-one colleges and halls the total consumption for the first halves of the Hilary terms (March quarters) of 1934, 1935 and 1936 were 234,776 kWh, 311,100 kWh and 519,723 kWh, respectively, and the full-term figures for the same years were 408,534 kWh, 532,772 kWh and 845,298 kWh. By far the best showing for an individual college is made by Merton, with 81,259 kWh for the Hilary half-term, 1936, and 136,142 kWh for the full term.

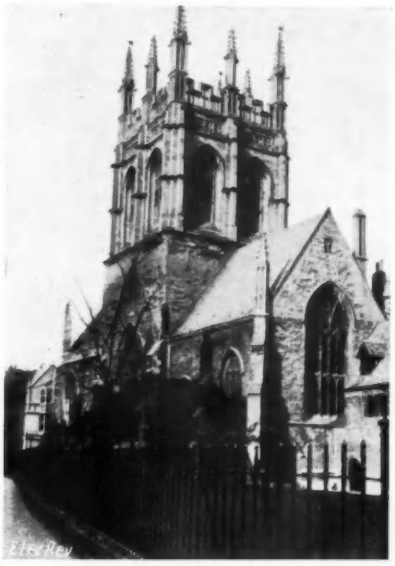
Merton's consumption for the year ended March, 1936, was 303,437 kWh, with a maximum demand of 216 kW, and the installed lighting, heating, cooking and water heating loads

A corner of Merton College kitchen

of the College were 34.3 kW, 37 kW, 147 kW and 26.2 kW respectively.

As to the building activities in Oxford, there is practically no scope for extensions or outward growth such as is the case in nearly all towns to-day, but the place is growing within its existing "built-up" area. A few open spaces here and there are being filled, mostly with blocks of flats, but the major growth is by conversion of existing large houses into flats, chiefly by a simple division of floors. In Oxford there are very many of these large houses that are going out of favour. The attitude of the Electricity Department to this conversion work is helpful. In each building is installed a rising main (steel armoured cable or v.i.r. cable in tube) to the top floor, with a feed at each floor. The rising main is regarded in the same light as a street main serving a similar number of consumers at ground level, each flat being metered at its own level and in most cases the whole main is installed without cost to the consumer. Of course, the consumption per building is very greatly increased. New flats are treated in the same way.

While it might appear that these peculiar influences on load-building at Oxford would adversely affect supply development, actually the output has risen from 6,950,000 kWh in 1931-32 to 20,660,000 kWh in 1935-36 (excluding 15,539,000 kWh sold to the Oxford Electric Co., Ltd., for use in the outer area where there are the works of Morris Motors, Ltd., and the Pressed Steel Co. of Great Britain, Ltd.). Between March, 1935, and March, 1936, the number of consumers increased from 11,865 to 12,886, and the installed load from 37,733 kW to 49,230 kW. The number of cookers installed rose from 1,888 to 2,750; water heaters from 750 to 1,722; washboilers from 369 to 712; and immersion heaters from 0 to 63. All these increases represent simple hire of equipment.



Merton College tower, the bells of which are now time controlled

In reply to our request for a simple statement of his load-building policy Mr. Fraser said: "We are out for all the load we can get on a balanced budget; we don't want either fabulous profits or subsidies, and we are staunch believers in diversity." The city electrical engineer prefers load factor shown as gross kWh distributed rather than net (kWh sold), claiming that if the lost energy is not included the basis is false. The 1933-1934 gross and net load factors for Oxford were 27.6 and 21.3 per cent; those for 1934-1935 were 32.8 and 27.45 per cent.; and for 1935-36 they were 34 and 29 per cent. The fact that, while the additional number of kWh sold during the year ended March 31st last was 7,000,000, the maximum demand increased by only 1,000 kW is evidence of the diversity of the domestic load and justifies the low tariffs prevailing.

Water heating development is very largely responsible for load factor improvement, particularly that on a comparatively large scale at the colleges. Typical of many of these installations is that at Wadham College, where a 60-gal. tank loaded at 6 kW provides the hot-water requirements of three bathrooms. It has been found that 4 kWh per bath is an ample allowance, including the standing losses.

Merton College has nine baths for undergraduates. Six of them run off a coke boiler and a group of three in another part of the building are fed by an electrically heated, thermostatically controlled tank. The coke boiler is shut down in vacations, but, as there are generally a few undergraduates in residence, the electric baths run all the year. They have just completed a full year's working and consumed 19,193 kWh. The cost at ½d. per kWh in the summer and ¼d. per kWh in the winter is just over £30. About ninety undergraduates live in the college. A third of them use the electric baths, so that the cost per head annually is about £1. The baths were selected for economy in hot water; if the large old type of bath had been used the cost would have been

The hall at the City of Oxford School, showing the thermostatically controlled tubular heaters

substantially more. In comparing such baths with coke or oil fired boilers it should be remembered that the cost of upkeep of the electric baths is negligible.

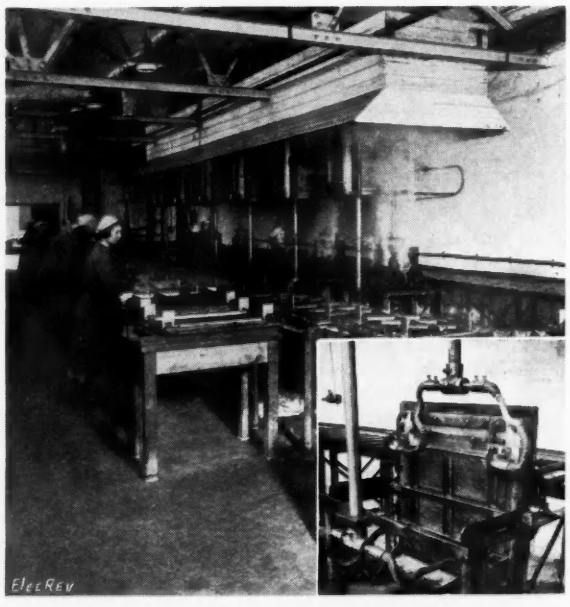
An outstanding development in the cooking field is a 250-kW G.E.C. baker's travelling oven which is now being installed for Messrs. Oliver & Gurden for the production of "Oxford Cakes." It is believed that this will be the first oven of its kind to be used for cake baking. It is to be part of a new installation which will also include three 36-kW two-deck peel ovens of the same make. This scheme dates back to the Bath and West Agricultural Show held at Oxford a couple of years ago, at which the Electricity Department had a stand and held baking demonstrations.

Mr. A. H. Fleming, B.Sc., headmaster of Southfield School, is very pleased with the cooking installation there. The equipment comprises a 25-kW cooker, a 14-kW fish fryer, and 8-kW hot cupboard, a 6-kW soup boiler, a 5-kW steaming oven, a 4-kW tea urn, a 4-kW vegetable boiler and two 2-kW kettles, all supplied on simple hire terms by the undertaking. Two hundred boys are catered for, and, during the year ended December 31st last, 23,207 luncheon meals were served for a total consumption of 7,920 kWh or 0.34 kWh per meal. Menus for the week commencing February 17th last were: Monday, beef and vegetable stew, potatoes, baked sponge and jam sauce; Tuesday, fish and potato pie, peas and steamed raisin pudding; Wednesday, roast beef, baked potatoes and bread-and-butter pudding; Thursday, potato pie, onions and ginger pudding with syrup; Friday, thick soup with lentils and steamed sultana pudding with custard The cost to each boy is 6d. per meal.

Included in the 147 kW of cooking equipment at Merton College are a 40-kW boiling table, an 18.5-kW cooker, a 17-kW pastry oven and a 10-kW time-switch-controlled roasting oven that has been installed in the open fireplace over which the turnspit is still in existence.

School Heating

During the past year four large schools in the city have been comprehensively equipped for low-temperature heating,



The Morris radiator works: the overhead transformers feed the jig-mounted guards, a close-up of one of which is inset

mainly by tubular apparatus. The total installed load at these schools is about 460 kW, and the aggregate annual consumption is about 250,000 kWh. Each installation is controlled by a 7-day dial time-switch so that the load can be switched on and off at various times of the day, thus providing not only "off" switching during peak-load periods but also programme switching to fit in with the school's activities. While in the City of Oxford School tubular heaters are installed around the skirting of the main hall and under the seats in the lecture rooms, in the chemical laboratory this scheme is impracticable because of the extensive wall cupboards, and so Unity flood-heaters are employed. Some of these "floods" are mounted on the ceiling and others on the walls.

"Comfortstats" are employed for the control of the panel heaters and ordinary thermostats for the tubes. To provide a conversion heating scheme for a college library presents many difficulties. Architectural features must be preserved, fire risk must be nil and fine temperature control is called for. At St. John's College library, however, electro-thermal storage space heating has met all these requirements.

In a chamber below the floor level have been fitted two 300-gal. storage tanks, each loaded at 30 kW and balanced over the three phases. The "Heatrae" heaters are operated by automatic switchgear and, in turn, finally controlled from the library above by thermostats. The 600 gal. of water circulated through ordinary wall-type "radiators" comfortably meets the heating requirements at all times, with daily two-hour peak-load restriction periods. During 1935 there were forty sets of rooms at Merton in which electric heating alone was used, the total consumption being 47,339 kWh, an average of 1,184 kWh. The average cost per undergraduate at ¼d. per kWh was £2 9s. 4d., the minimum being £1 8s. and the maximum £5 18s. The average cost where coal fires were used was about £4 5s.

The bells at Merton having recently been adapted for automatic control will now be heard at every hour. The hands of the old 5 ft. dial clock in the quadrangle are driven by an electrical impulse dial movement from a "Synchronome" master clock in the porter's lodge, and advantage has been taken of this installation to operate the bells. Current impulses at predetermined times stop and start the striking mechanism. A ½-h.p. motor operates the hammer of the great hour bell and a similar motor works the quarter chiming.

Flexible Distribution System

The distribution system of the undertaking is designed to give adequate flexibility for the load growth indicated. Main distribution sub-stations in the north, south, east and centre of the town are fed from the power station by inner and outer 11-kV ring mains. Other sub-stations are, in turn, ring-main fed from the main sub-stations either at 11 kV or 3 kV, and, except in the centre of the city where the 3 kV system is to be maintained because of its greater flexibility, all new equipment is designed for ultimate operation at 11 kV.

As the load on the 11 to 3-kV step-down transformers approaches a safe maximum some or all of the minor ring mains and "subs" are changed over from 3 kV to 11 kV. Each sub-station has its own l.p. system, and automatic on-load tap-changing provides the necessary pressure regulation demanded by the cooking-load variations and developments. To meet next winter's demands work is already well in hand on the installation of nine additional miles of 11-kV cable, seven new sub-stations and extensions to existing sub-stations.

At the moment the Electricity Department is in the midst of an extensive public-lighting conversion scheme embracing fifteen miles of streets. G.E.C. "Difractor" lanterns with dome-shaped tops have been adopted for this scheme, and initially they are being equipped with 500-W tungsten lamps, but the lanterns are also designed to take 400-W or 250-W discharge lamps, for Mr. Fraser is confident that sooner or later discharge lighting will be generally accepted. Bromford tube lamp standards high enough to permit the lamps being 26 ft. above the roadway and with sufficient internal base room eventually to house the discharge-lamp choke and condenser equipment are being used. The engineer's aim is to provide main-street lighting good enough to render motorists' headlamps quite unnecessary.

A refrigerator campaign has recently been introduced whereby an appliance with 3½ cu. ft. capacity of cold storage, can be obtained on hire-purchase at 2s. 6d. per week, or 20 quarterly payments of £1 12s. 6d., with five years' complete guarantee and maintenance.

Even in such an essentially residential city as Oxford we did not have far to search for something of interest in the industrial field. At the radiator works of Messrs. Morris Motors, Ltd., where 1¾ million kWh is consumed annually, heavily tinned steel strips, after being corrugated continuously, are built up in a jig side by side with the corrugations in face-to-face contact, the whole being clamped from side to side between heavy copper electrodes. The electrodes are then connected to specially constructed overhead transformers and a maximum current builds up in a few minutes to about 3,000 A at 2 V, thus providing the necessary heating for sweating all the strips together.

At the University Press particular interest in the drives lies in the installation of motors in an old subway which originally housed the gas-engine driving the main shafting. Seven Asea commutator-type, variable-speed motors drive colour-type machines incorporating the unique process of printing on glass. The largest of a number of letterpress machines is a "Miehle" extended eight-crown machine capable of printing closely worded matter on a sheet measuring 69 in. by 45 in. Excluding newspaper plant, it is believed to be one of the largest machines of its class in use. With an installed capacity of 750 h.p. and a maximum demand of 345 kVA the annual consumption at these works is 300,000 kWh.

Different Types of Load at Oxford. (See preceding pages)

1. A section of the new street lighting. 2. "Flood" heaters and "Comfortstat" in the laboratory at the City of Oxford School. 3. A main sub-station; the 11-kV switchgear on the right was specially modified to fit the old low-ceiling building. 4. Heavy duty kitchen equipment at Southfields School. 5. Part of the bathroom installation at Wadham College. 6. The machine room at the University Press. 7. Variable-speed chain drives in the old shafting tunnel at the University Press

The I.E.E. Rules. By H. R. Taunton, A.M.I.E.E.

Some further points and conclusions

SECTION 12 of the tenth edition of the I.E.E. Wiring Rules, dealing with private generating plants, will interest only the few contractors who still specialise in country-house work. Perhaps it will find no place at all in, say, the twelfth or thirteenth editions, when the grid will have covered all England. Those who to-day have still to refer to it will find it straightforward enough, little changed from the last edition, except in its grouping of scattered rules and in minor details.

Section 13, on the design and construction of electrical apparatus, is the longest in the book. The average contractor, however, may safely ignore it. Its necessary inclusion, in a code dealing with the electrical equipment of buildings, is more for the benefit of manufacturers. Theoretically, the contractor is supposed to satisfy himself that the apparatus he buys from them complies with this section. In practice, he is only concerned to get a satisfactory article at a satisfactory price, and he takes for granted that it is made to the appropriate B.S.S.

He can hardly do anything else. It would, for instance, be almost impossible for him to verify that a particular sample of cable had been designed, manufactured and listed in exact accordance with Rules 1304 to 1313, occupying more than half the section. He can be reasonably sure, however, that if he buys it from a British maker it will be all it should be in its particular grade. (If he's the sort of contractor who buys cheap foreign cable he will not be worrying about the Rules in any case.) The same applies to almost any standard electrical material; if he be wise enough to buy only from makers of repute he need have no fear of their involving him in any breach of the rules in this section.

One item to which this remark does not apply is lighting fittings. Except in the case of the more or less standardised factory and office fittings, the contractor cannot take it for granted that designers and makers have given any thought to Rule 1323. In the average ornamental fitting there is usually to be found a breach of most of its nine clauses. (J, by a recent amendment, has been deleted.) More particularly is this so in the "special" fittings made by the craftsmen favoured by so many architects. It is unlikely that any of these folk have ever heard of the Wiring Rules, and, were they told of them, they would certainly scorn such shackles on their art.

Built-up Switchboards

Rule 1301 should be read by those contractors who, as many do, build up their own switchboards, usually an assembly of ironclad gear on steel framework. The rule, however, is very much the same as 64 in the ninth edition. Fuses protecting instruments and pilot lamps may now be fixed on the back of the board (Clause F), and Clauses H and O of the old rule are now omitted.

Rule 1320 is interesting. The latter part of it represents, I believe, a concession to the views of practical contractors who were not satisfied with the original intention to allow the use only of B.S.S. malleable iron boxes. They voiced a partiality for c.i. boxes; and these accordingly are now allowed as an alternative, subject to compliance with the specification given in Clauses A to D. Here again, therefore, since such boxes may be obtained from other than well-known conduit makers, the onus is on the contractors to see that the goods comply with the regulation and, as required by Clause C, are marked accordingly.

Rule 1324 is curious. As it stands it is merely a repetition of 601A (installation of ceiling roses) and has no place in a section dealing with the "construction" of apparatus. The note attached to it, however, does specify that ceiling roses shall be made to B.S.S. No. 67. Surely the note should have been made the rule, and the "rule" should have formed a note to it, if it were thought worth repeating at all.

Clause I of Rule 1332 has been amended so that it need not apply to breakers of less than 15 A, but Rule 612 (to which it refers) has not been amended, as it needs to be, to accord with it.

Earthing Domestic Appliances

Rule 1337, stipulating that the frame of every heating and cooking appliance shall be provided with an earthing terminal, is important. It is to be read, of course, in conjunction with 1001C. Non-compliance with either rule renders the other nugatory. The trouble is that however anxious a contractor may be to comply with them he is constantly thwarted by manufacturers. How many electric irons, how many portable radiators are sent out fitted with earthing terminals? What is the poor contractor to do with the many that are not? Wink at a breach of the rules, for which, in the end, he may be made responsible, or insist on the terminal being added, incurring delay and expense? Why should he have to shoulder all the trouble? The B.E.A.M.A. was amply represented on the Committee. The least it can do is to ensure that *all* its members observe the rules as exactly as the contractor is required to do.

Section 14 consists of tables, most of which have been referred to already in this series of articles. Some of the tables are quite new, *e.g.*, the first three—and as a whole they are much fuller, not to say more complex, than those in the ninth edition. The old Tables IV and V, dealing with cables, with which most of us managed to get along very well, were simple enough almost to be memorised. It would puzzle Datas to memorise the eight elaborate tables into which they have now expanded. They contain an enormous mass of new detail; "but vether it's worth while goin' through so much to learn so little, as the charity boy said ven he got to the end of the alphabet," is a matter of taste. However, we shall doubtless learn in time to handle them familiarly, as we learnt, grumbling, to speak of 3/22 as 3/0.029.

The book ends with appendices, No. 5, the longest, being by way of further elaboration of the wiring tables, which most of us will take as read. The other new appendices are No. 4, specifying insulating materials for switchboards, and No. 2, giving the list of B.S.S. graphical symbols. These were criticised when they were first published;* and the doubt then expressed, that their complexity would prevent that general adoption of them which alone would make them worth while, has been amply justified.

Qualified Approval

"Complexity" seems a suitable word with which to end this review of the tenth edition of the Wiring Regulations. It is the chief criticism to be made against them: that they are complex, a little in matter, and very much in manner. That in many ways they are a definite improvement on the previous edition must be agreed. The division into sections following a logical order, facilitating the marshalling of hitherto scattered rules, is a step forward. It could be carried further, as in the case of the sundry rules on bell work. Their present chief defect is an apparently needless amount of repetition, many rules being duplicated in different sections, swelling the bulk of the text. A better alternative, which indeed has been largely adopted, is to give a reference when it is desired to call attention to a rule cited elsewhere. That, too, can be overdone; and it is merely exasperating when, as in Rule 1008, the reference is only to another.

The tenth edition, too, is improved by the addition of certain new rules and the alteration, generally for the better, of some of the old rules. The tendency is to greater stringency; and in so far as it may serve to check shoddy wiring, that is all to the good. But, again, it can be overdone: a code too stringent, too complicated, spells stagnation. "Safety First" is an admirable ideal, but it does not make for progress. Man would have achieved little of what he boasts to-day had that always been his motto.

Some of the rules—not many, to be sure—are needlessly restrictive, harassing, pettifogging. That is always the danger with any large committee—Parliament itself is a cautionary example. Every member wants to express his own ego, and we get over-legislation—fatal to a still-developing industry, such as ours. It should be left as free as possible, guided only by a minimum of rules directed to essentials. A higher standard of safe and efficient electrical installation work will eventually be attained by a rigid enforcement of a simple code, rather than by an over-elaboration which naturally invites evasion.

And a simple code should be simply written. That is the chief fault of the present edition: the merit of many of its rules is so involved in legal and technical verbiage that the contractor or foreman to whom they are addressed can hardly be blamed if he either misunderstands them, or finally ignores them as unintelligible. Bluntly, they are not written in reasonably good English.

Nor is that, as many seem to think, a matter of minor importance. Any rule, any message, must lose half its force if it be blunted by a vague and clumsy diction. I would like to suggest that whoever was responsible for the circumlocutions of our wiring code should be shut up for a few weeks with, say, a set of Defoe's works: "Robinson Crusoe," "Moll Flanders," "The Plague Year," and the rest. After reading them through two or three times he would begin to realise that it would have been possible to say exactly what he had to say in two-thirds of the space, without any sacrifice of legal precision, and withal in words simpler, clearer, and more easily read and remembered.

* Electrical Review, June 3rd, 1932.

Radio Relay Distribution Networks. By T. H. Hall

Lessons from the "Radiomains" system, Kettering

THE distribution of programmes from radio relay stations to consumers' premises presents problems peculiar to itself. To bring the service within reach of every possible subscriber necessitates the erection of a network as extensive as that of the local electricity supply undertaking, while the comparatively small revenue necessitates inexpensive wiring, although efficiency is essential. Underground cables are out of the question, except in isolated instances, so an overhead system utilising chimneys and poles has to be employed. Several types of line construction are in favour at present, each suitable under certain circumstances. Band brackets held in position by galvanised straining wire passing right round the chimney and tightened by straining bolts, are used very extensively, small plates at each corner of the chimney preventing the wire from cutting into the brickwork. As no nails are driven into masonry, this type of construction is preferred by property owners and facilitates the obtaining of wayleaves.

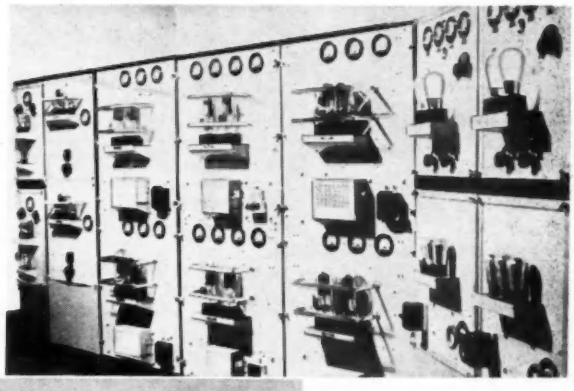
Corner brackets and flat wall brackets are necessary in some cases, on high property, on party chimneys where only one landlord will consent to the fixing, and on property where wayleaves are only granted on condition that wiremen do not go on to the roof. "J" bolts, to which the insulators are screwed, are passed through the eye of the bracket, double-eye brackets accommodating two such "J" bolts. The type of assembly depends on the type of wire employed, the length of spans, and the possibility of corrosion due to fumes from factory chimneys, salt-laden air in coast towns, &c.

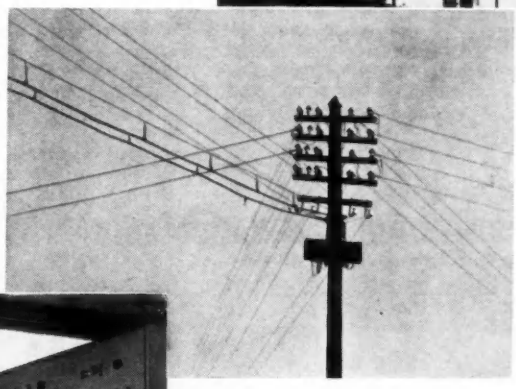
I personally favour the use of insulated wire carried on double-groove insulators, supported by double "J" bolts on single-eye brackets. The final appearance is neat and meets with the approval of property owners, as the conductors are run vertically. The single-eye bracket means less ironwork and less leverage on the bracket, the arm being several inches shorter than that of the double-eye type. This is a great advantage where nailed brackets have to be employed. If the eye of the bracket and the collar of the "J" bolt are serrated, the possibility of the bolt slipping and allowing the wire to slacken is remote. The cost may be reduced by using two insulated wires and two bare wires, but the risk of "shorting" when wires are slackened by buffeting during gales must not be overlooked. Many engineers assert, however, that certain types of braided wire fray more quickly due to rubbing contact between themselves than between one bare and one insulated conductor.

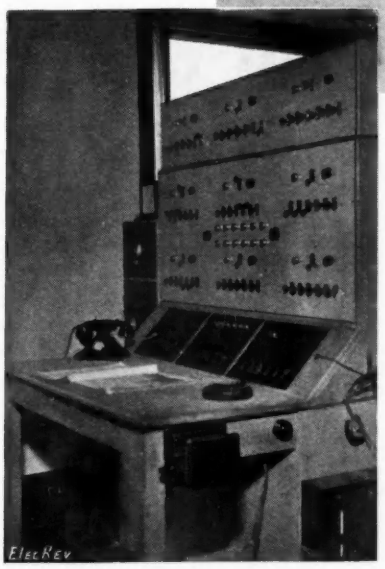
Single-groove insulators mounted on two double "J" bolts in double-eye brackets can be used with the wires supported in a square formation, providing a six-inch overall spacing to enable bare wires to be used. This is a cheap system, and allows easy transposition of conductors to overcome induction, but it is unsightly and incurs heavy losses in wet weather. Another disadvantage is that feeders cannot be teed off, unless to a higher or lower bracket; otherwise the wire from the insulators at the rear will foul the lines on the front insulators. This bracket can be used to advantage with insulated wires for erecting long spans where the extra spacing is useful.

Cadmium-copper wire is used for its tensile strength, and the insulation is usually in the form of a sticky weatherproof braiding. A cotton lapped and lacquered wire is on the market, but the life of this insulation has been found to be rather short. A covering known as "Telconax" now coming into favour is produced by blending bitumen, wax and rubber, and is tough and flexible when cold, but plastic when hot. Extremely good dielectric properties are claimed for this material, which is unaffected by moisture and mild acids, even after long immersion.

Twin cables are being employed by some companies, either with the conductors laid flat side by side or twisted. Such cables are usually v.i.r. insulated and form an almost ideal system, as there is practically no line leakage, and resistance to earth and between programmes does not drop in damp weather The cost of such cable is only slightly higher than that of two single insulated conductors and the cost of erection is considerably less. The thickness of the cable makes it rather unsightly, however, and the extra weight makes it impracticable to erect very long spans.







Equipment at the main station of "Radiomains," Kettering. Top: Amplifiers, with driver panels on extreme left. The circuit is low-loading push-pull, giving 120 watts speech output from two 100-watt valves. Centre: Main distribution pole. A multicore cable slung on a catenary links it with the station. Bottom: Control panel, incorporating line-testing apparatus

The usual gauge of wire for main trunks is 16 s.w.g., although in some cases where unusually long lines are being planned it is useful to start a trunk with 14 s.w.g. and then drop to 16 s.w.g. For the feeders to subscribers' premises and for wiring at the end of the line 18 s.w.g. is sufficient. The lines are erected with a straining vice.

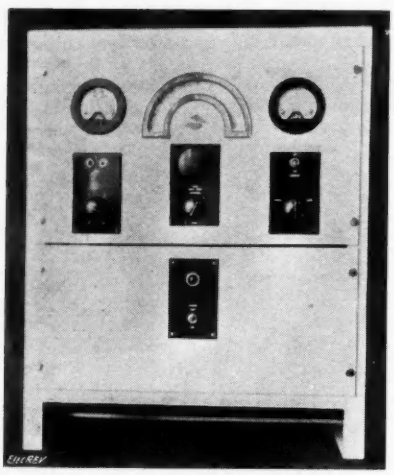
Planning the Lines

Time spent in planning the route of a line is by no means wasted. A good method is to obtain a map of the whole area to be served and to mark off segments from the distributing station that should ultimately yield about 200 or 300 subscribers, numbers that can be conveniently fed from one amplifier. The main trunk lines should run straight through each area, ignoring for the time being subscribers who lie a little off the route. Feeders can lead off at intervals. The location of a fault on any one trunk is thus simplified, as the search can be confined to a section of the town. Twisted joints are most commonly used and are quite satisfactory if they are first covered with a high-grade rubber tape and then bound with black insulating tape. Soldering overhead lines is seldom satisfactory and one will be well advised to avoid it unless one can be certain that wiremen will clean the joints thoroughly and varnish them over.

It is possible, of course, to run the lines down to eaves brackets and then use lead-covered cable into the subscriber's house, but it is more satisfactory to use a four-core lead-covered cable from the chimney bracket, laid on the slates, bent over the guttering and then clipped down the wall. The cable has to be specially manufactured and is expensive, as it is essential that the pairs be screened to prevent induction between programmes. This cable should be v.i.r. insulated, with either a fillet of lead between the two pairs, or a wrapping of metallic paper round each pair. When wiring a block of houses it is necessary to run only one such cable from

the airline, broken at a convenient height with a watertight metal or bakelite junction box inserted. Lead-covered cable can be run from this box to any other consumer in the block.

A two-way switch and a loud speaker complete the subscriber's equipment. The switch usually incorporates protective devices to safeguard the service from short-circuit, either a resistance in each leg of the speaker cord or a condenser of a capacity not likely seriously to affect quality of reproduction. The condensers are sometimes mounted on the bracket outside the house, affording protection against anything happening to any part of the installation. I prefer to use two 250-ohm resistances in the programme switch and one 0.5-mfd. condenser in the loud speaker itself. The resistances give protection against a "short" developing on the speaker flex, and the condenser ensures that the line shall always be open circuited, facilitating fault finding.



Typical 6-valve superhet relay receiver. The meters are for tuning and registering output voltage

Selecting Suitable Loud Speakers

The essential requirements of the loud speaker are a low "greed" factor, moderate price, and absolute dependability, coupled with good quality reproduction and attractive appearance. I favour the use of a speaker with an impedance approximating to 8,000 ohms at 1,000 cycles per sec., employing a low resistance speech coil and an input transformer. If the selected impedance is too low, current consumption will be excessive, also the impedance of the speaker load will approximate to the line impedance and a large percentage of the current from the amplifiers will be dissipated in the lines. It is inadvisable to employ speakers of a higher impedance than 8,000 or 10,000 ohms at 1,000 c.p.s., unless the wiring system is exceptionally well constructed. The line voltage depends on the impedance of the speakers, and if too high an impedance is selected the line voltage will be excessive and the risk of induction effects causing cross talk will be correspondingly great.

Some types of relay speakers do not incorporate transformers, and have instead a high impedance speech coil of 1,000 ohms. Such a low impedance speaker involves enormous line losses and is unsatisfactory, except in isolated cases. Very fine wire has to be used in the speech coil for this type of speaker, entailing increased risk of breaking; also the extra mass in the coil robs the speaker of all its transient qualities of response. However, the smallness of the transformers usually employed means that their efficiency is fairly low, frequently of the order of only 60-65 per cent. Thus there is fairly serious loss here.

Volume control is essential and should be incorporated in the speaker. A robust type is necessary. Quite 50 per cent. of the service visits in the Kettering system are for repairs to volume controls. The wasteful potentiometer type of control is now obsolete, and there are several very efficient types of choke controls for wiring in series with the secondary winding of the transformer and the speech coil. They should be designed so as not materially to alter the load reflected back to the primary of the transformer, with the tappings placed correctly to keep the frequency/impedance ratio constant for all settings, avoiding the distortion common to most volume controls. In the full-on position all available energy should be allowed to reach the speaker.

A relay operator is well advised to use nothing but the best materials and workmanship in the construction of his distribution system. With an efficient network, only a skeleton maintenance wiring staff need be employed. A poorly constructed system that needs frequent attention is a heavy expense to maintain and will result in dissatisfaction with the service, bringing ultimate loss of subscribers.

Modern Transformer Developments

FOR converting energy generated as three-phase into two-phase for single-phase distribution (usually in two distinct circuits) the Scott connection, which requires two separate single-phase transformers, a teaser and main unit, has been generally employed.

A connection which has been developed by the Fuller Electrical & Manufacturing Co., Ltd., employs a standard three-phase core, the three-phase winding of which is of the normal star-connected type enabling the tappings to be brought out in the ordinary way. The Scott connection has a more complicated tapping arrangement, and the two halves of the winding on the main unit must be interleaved to prevent undue reactance.

One of the single-phase circuits of the Fuller system comprises a closed-delta winding, which has the incidental advantage of stabilising the transformer and providing a circulating path for the third harmonic currents, resulting in the suppression of the harmonic voltage in the line. As one three-leg transformer is required, instead of two single-phase transformers, the losses (particularly at no-load) are usually less, and the cost is found to be lower than with the Scott connection.

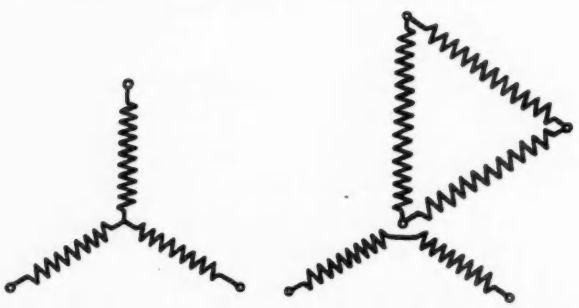
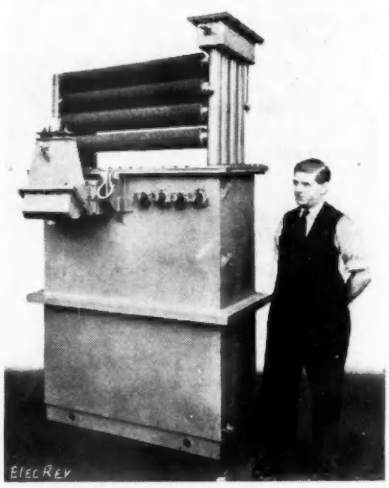


Diagram of connections showing that one of the single-phase circuits of the Fuller system comprises a closed-delta winding

Probably the most advantageous case for the Fuller connection is for a three-two-phase bank, with a ratio of, say, 6,600/2,200, fitted with on-load tap-change equipment, when a standard on-load switch can be employed. Further, any magnetic unbalancing due to the large tapping range can be minimised.

This connection has been used for several years with great success, particularly in Sweden, where it was developed by the A.S.E.A. Co., with which the Fuller Electrical & Manufacturing Co. is in association.



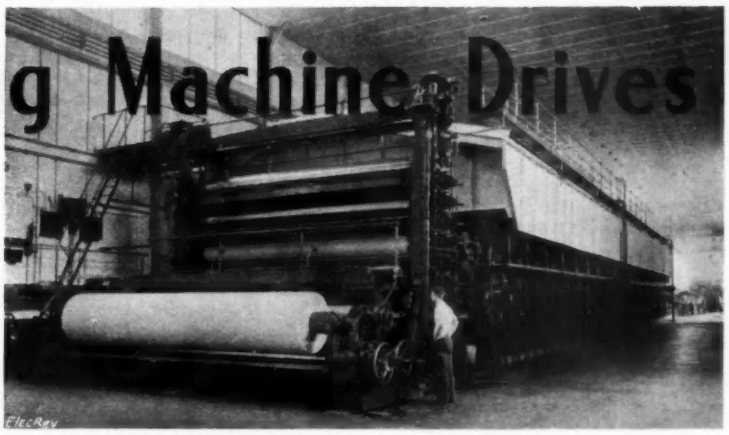
A 300-kVA, 3-phase, 50-cycle, 6,600/400-V transformer with the radiating tubes in the cover instead of on the sides of the tank

Another recent development by the Fuller Co. is the placing of the radiating tubes of a transformer in the cover instead of on the sides of the tank. It is claimed that the maximum efficiency is thereby obtained from the cooling tubes. All joints are under oil, and a conservator tank is obtained without added expense.

The fitting of the radiating tubes in the cover gives a clear and unrestricted path leading to the terminals or cable box. While the height of the transformer is increased, the reduction in the plan dimensions is an advantage in many cases.

Paper-making Machine Drives

The sectional electric system for speed control



The large machine at Bowater's Mersey Paper Mills

ON the reliable and efficient driving of the paper-making machine in a paper mill depends the production of paper having a uniform thickness and weight combined with freedom from breakages. The various sections of the machine must run at steady speeds which are kept constant in relation to each other, and the drive must be capable of speed variation over a range to suit the various classes of paper to be made. Newsprint machines now produce paper in width and speed far ahead of anything in existence a few years ago, and such machines require powers beyond the economical capacity of the older forms of belt and rope drives. During recent years the Schräge-type a.c. variable-speed commutator motor, which has a shunt characteristic, has been adopted for some of the largest paper-machine drives.

A machine for producing newsprint at Bowater's Mersey Paper Mills, equipped with B.T.H. sectional electric drive, has a width of 230 in. and a maximum speed of 1,300 ft. per min. There are ten sections, each driven through a single-reduction totally enclosed gear by an a.c. variable-speed commutator motor having a working speed range of ten to one. The 1,340 h.p. of motors are fed from the 440-V 50-cycle three-phase supply. The speed of the couch and calender motors is 500 r.p.m., and of the other motors 870 r.p.m.; each dryer unit and the calender has a 25-h.p. 715-r.p.m. squirrel-cage barring motor. Each driving unit is controlled from a drum-type master controller mounted on the front of the machine and connected to the corresponding panel of the main board. The units are independent and can be started and stopped separately.

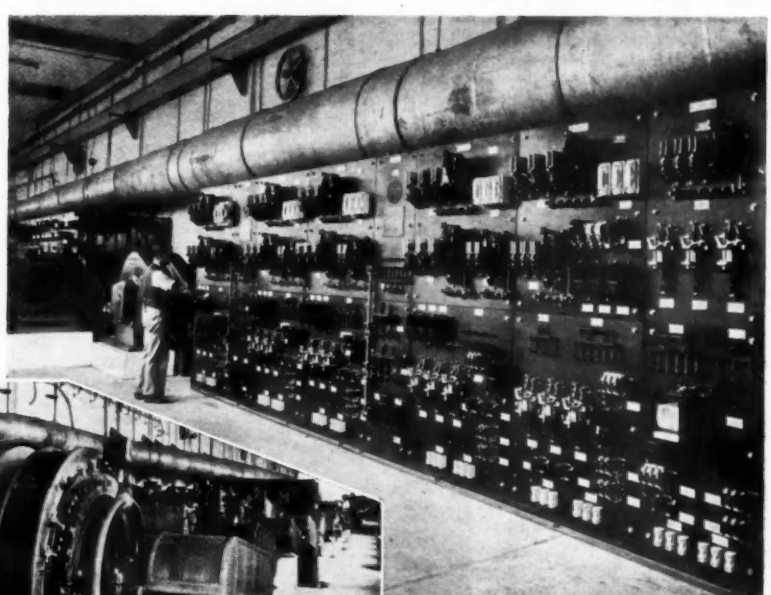
Regulating gear holds the speed of each main motor constant under all load conditions, thereby maintaining a constant relative speed between sections and keeping the "draws" at fixed predetermined values. The principal part of the regulator consists of a synchronous regulating motor, with both frame and rotor carried in ball bearings, so that both are capable of rotation.

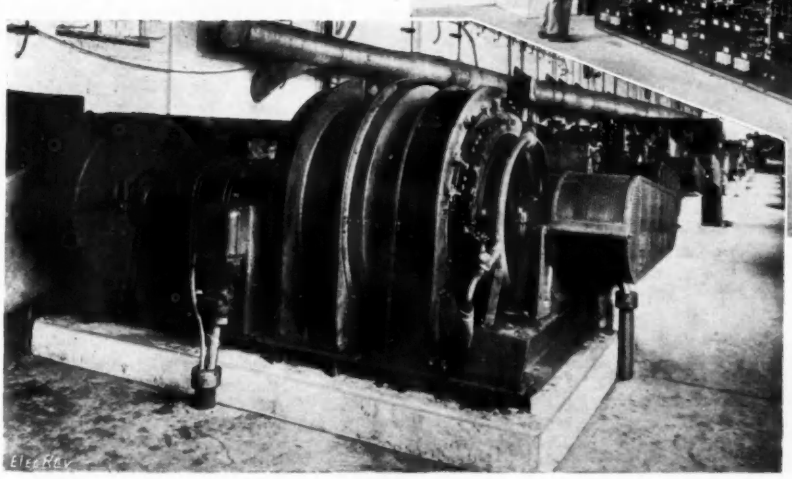
The frame has a three-phase winding connected to three collector rings, and the rotor a winding to which d.c. is supplied through two collector rings to give multipole excitation. The rotor has also a squirrel-cage winding which comes into action at starting. The three-phase winding is fed from the small alternator of the master-speed set driven by a variable speed a.c. commutator motor, the speed of which determines that of the whole machine; the d.c. supply to the rotor comes from an exciter driven by a s.c. motor, and this also supplies the field winding of the alternator.

The three-phase field of the regulating motor revolves inside the frame relative to the windings, but when the main motor is running at the working speed the frame itself is driven by the belt and cone pulleys at a speed equal and opposite to that of the field, so that the latter stands still in space and interlocks with the field of the rotor which is at rest. Should the speed of the main motor commence to change, however, the three-phase field begins to move round and, by taking the rotor with it, readjusts the brush position of the main motor through the chain drive between the rotor and the brush shifting spindle, thereby restoring the speed to its correct value.

Since all the regulating motors have the same source of supply, the frames must all run at the same speed when the three-phase fields are at standstill; but the main motors can run at different speeds in order to give the requisite draw between the sections by having the belts at suitable positions on the cone pulleys. The draw is adjusted by moving the belts along the pulleys, by means of a sliding frame carrying pulleys with flanges between which the belts ride. This adjuster is carried on the same casting as the regulating gear, and is worm-driven by a pilot motor operated from the front of the machine by a watertight draw-adjusting switch. Incidentally, the draw can also be adjusted by a handwheel at the adjusting gear.

The speed of the whole machine depends on the frequency and therefore on the speed, of the master speed set, which is controlled from a central panel in front of the machine. The control switch operates a pilot motor which moves the brushes





Left: The electric drive from the wet end of the machine shown above. Right: Part of the control board

of the variable-speed motor of the master set, and so changes the speed up or down. The central control panel also carries a speed indicator (operated by a small generator driven from the calender gear) for giving the speed of the paper in ft. per min. at the calender, and a

push button for shutting down the whole machine in emergency.

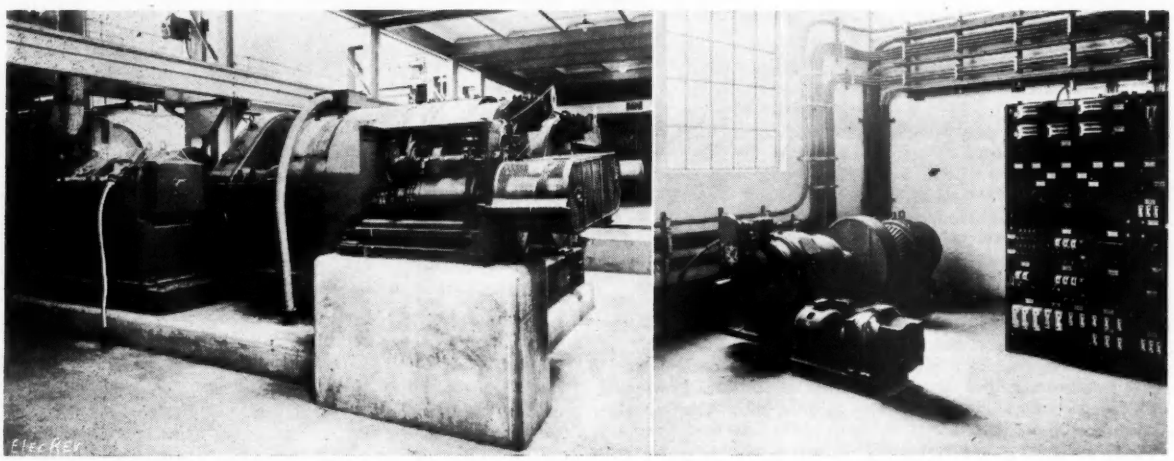
For starting the couch and presses the controller is thrown full over and the main contactor on the panel closes, provided the brushes of the main motor are at the bottom-speed position, an interlock switch on the motor being provided for this purpose. Simultaneously, contactors on the panel connect in the regulating motor and a pilot motor mounted on the regulating gear. The regulating motor behaves at first as a squirrel-cage machine and moves the brushes to run the main motor up to speed. The pilot motor, however, being connected to the same motion through a worm gear, prevents the regulating motor from going beyond a fixed speed, and thus controls acceleration of the main motor.

As the speed of the main motor rises, the frame of the regulating motor revolves at a correspondingly increasing speed and the revolving field slows down in space until it finally comes to rest and interlocks synchronously with the rotor field. As the rotor of the regulating motor is now at rest, the continued movement of the pilot motor separates contacts on a disc on the regulating gear and thereby cuts itself off and stops. The regulating motor is now free to control the speed of the main motor. When shutting down, the controller is thrown to the off position, contactors for the main motor and regulating motor drop out, and the pilot motor, by running in the reverse direction, brings the brushes to the bottom-speed position, where the limit switch on the motor is opened and the pilot motor cut off.

A creeping speed for such operations as wire inspection and fitting new felts in the presses, is obtained by moving the controller through a short distance from the off position to a special notch. Only the main motor is now switched on and this runs up to the speed corresponding to the lowest brush position, about 100 ft. per min. Inching is obtained by moving the controller to and fro between the off and creeping speed positions.

The dryer and calender sections require very heavy starting torques, and s.c. barring motors and gears give a creeping speed of 120 ft. per min. at the dryers and 60 ft. per min. at the calender. When running up normally the controllers are thrown full over and the barring motors are first switched on; after they have reached full speed the main motors automatically take charge of the load and run up to the working speed.

The barring gear includes in each case an over-running clutch, and as soon as the main motor runs above the barring speed the clutch is automatically disengaged, thereby mechanically disconnecting the barring gear; at the same time the barring motor is automatically switched off. As before, the regulating gear automatically takes care of the speed of the main motor when the latter has reached the speed for which the paper machine is set. Creeping and inching are carried out by moving the controllers to the special notch, when only the barring motors are switched on. A controller is not required for the reel, start and stop push buttons being used instead; provision for inching and creeping is unnecessary in this section.



Left: The calender unit of the machine at Lloyd's Kemsley Mills, showing barring and regulating gear. Right: Master speed and exciter sets at the Greaseproof Paper Mills, Dartford

The steady running of the a.c. drive is largely due to two inherent characteristics. First, the speed can be regulated precisely, since the brush movement gives a smooth stepless-speed change. Secondly, high sensitivity of the regulating gear can be obtained without hunting, because any movement of the brushes meets with a rapid response in the speed, the time lag in the windings being negligible compared with a regulator working on a d.c. field system.

The newsprint machine in Messrs. Edward Lloyd's Kemsley Mill, which is the largest paper-making machine in the world, was described in the Electrical Review of January 31st; it has a width of 320 in. and a maximum speed of 1,400 ft. per min. The supply is 430 V, 3-phase, 50 cycles, and the motor equipment for the B.T.H. a.c. drive totals 2,255 h.p. The barring motors enable low creeping speeds to be obtained in all sections without necessitating a wide speed range for the main motors, and give the requisite heavy starting torques for the dryers and calenders.

In the Greaseproof Paper Mills, Dartford, two machines in the same house, each with a B.T.H. a.c. drive, are engaged in the manufacture of a high class of fine paper. One machine, which is in sixteen sections, has a width of 185 in., and a speed range between 98 and 490 ft. per min. The motors are of 125, 45 and 25 h.p., supplied at 400 V, three-phase, 50 cycles. No barring motors are used, the main motors being of sufficient capacity to take care of the heaviest starting torques.

The drive for one of the machines at the Greaseproof Paper Mills, Dartford

A new type of d.c. drive at 275 V has recently been put into operation by the B.T.H. Co. The machine is 134 in. wide and is designed for the unusually large speed range of 45 to 600 ft. per min. to meet the large variety of papers being made. The voltage is varied by a motor-driven booster, the field of which is adjusted by a Ward-Leonard controller.

The couch and calender each have a 70-h.p. motor, and the two presses and two dryer sections each a 30-h.p. motor. The reel is driven from the calender. The sections are started individually by a master controller, contactors, and series resistance in the armature circuit, which is cut out in steps. The speed of the machine is determined by the booster volts up to 400 ft. per min., and above that by motor-field weakening.

The novel feature of the drive is the method of obtaining constant draw and constant speed of the whole machine. Each main motor is coupled to a selsyn machine (a slip-ring induction motor run against its field) through a belt and cone pulley drive. The selsyn machines are all connected in parallel to a master selsyn driven by a d.c. motor fed from the booster, and therefore having a speed depending on the booster volts in the same way as the main motors. The master selsyn obtains a three-phase supply from a motor-driven alternator, which also carries a fan for providing forced ventilation to the totally-enclosed motors and selsyns.

Since the selsyns run at the same speed and are connected to the main motors through belts, they hold the relative speeds of the motors constant. The motors carry the main load and the small selsyns are subjected only to load variations. When the load, either motoring or generating, on any selsyn rises above a predetermined value, the field of the main motor is automatically changed by a motor-operated rheostat so as to transfer the excess load from the selsyn machine to the main motor.

Constancy of speed of the whole machine is obtained by making the master selsyn run at constant speed, by means of a relay and tuned circuit, which is connected to a magneto generator directly coupled to the motor driving the master selsyn. The circuit is tuned to a point a little below resonance by means of a condenser and reactance, and the current change is, therefore, great for a small change in speed and frequency. The relay actuates a motor-operated rheostat which varies the strength of an auxiliary field in the master selsyn motor, and thus holds the speed constant within extremely small limits.

The Commissioners' Fuel Returns

Further stations closed down

THE number of generating stations included in the "Analyses and Summaries of Fuel Consumption and Units Generated" during the year ended December 31st, 1935, was 458. In 1934 the number was 470, the difference being due to the closing of twenty-seven stations, the putting into commission of six new and two stand-by stations, and the inclusion of seven previously non-statutory stations. This return includes not only authorised undertakings but also traction and certain non-statutory undertakings.

The return, which was issued by the Electricity Commissioners on Tuesday (Stationery Office, 1s. 6d.), comprises, in addition to an explanatory preface eight tables, the first two of which show the numbers of power stations in each of the ten regional areas and of thirteen classes grouped according to kWh generated. A third table contains particulars for individual stations of kWh generated, type of fuel used, fuel consumption per kWh, thermal efficiency, m.d. on generators and annual station load factor.

The remaining tables give the names and salient details of the stations with the lowest fuel consumption per kWh and highest thermal efficiency in each group (classed in accordance with kWh generated), average fuel consumption for various types of prime mover in each such group and in each regional area.

A Hydro-electric Increase

The total kWh generated at these stations was 18,993 million, an increase of 12.42 per cent. on 1934, for a fuel consumption of 12.5 million tons, an increase of 8.9 per cent. Of this total 95.33 per cent. was produced by steam stations, water power coming second with 3.29 per cent. (625 million kWh), compared with 2.75 per cent. in 1934; this advance represented 161 million kWh, about half of which was due to the operation for eight and ten months of the first two stations of the Galloway Water Power Co. This had the effect of reducing the proportion of the whole contributed by the steam stations (though their output of over 18,000 million kWh was up by nearly 2,000 million kWh) from 95.52 in the previous year.

In every other category also the percentages of the total showed a decline—although the aggregate output (66 million kWh) of the 139 oil-engine stations forming 0.35 per cent. of the whole, was slightly more than in 1934, when six more stations were in operation.

The average coal consumption per kWh generated in the steam stations was 1.54 lb., an improvement of 0.04 lb., the consumption declining strictly in order of output, from 1.34 lb. for the twenty-seven producing over 200 million kWh in the year to 7.92 lb. for the eight generating under 250,000 kWh each.

The lowest fuel consumption per kWh generated, 0.96 lb., as well as the highest thermal efficiency, 28.59 per cent., was returned by the London Power Co. for its Battersea station. Barking B of the County of London Co. came second under both headings with 1.09 lb. and 28.07 per cent., followed by Dunston B of the N.E.S. Co. with 27.25, Clarence Dock (Liverpool Corporation) 26.21, and Ironbridge (W. Midlands J.E.A.) 25.59 per cent.

Twenty-six other stations achieving thermal efficiencies of more than 20 per cent. were, in order of merit: Blackburn Meadows New (Sheffield), Spondon (Derby and Notts Co.), Kearsley (Lancs E.P. Co.), Deptford West (London Power Co.), Hams Hall (Birmingham), Brimsdown B (North-Met. Co.), Kirkstall (Leeds), Portishead (Bristol), Portobello (Edinburgh), Barton (Manchester), Hackney, Brighton, Barking A (County of London Co.), Thornhill (Yorkshire Power Co.), Scalcoates (Hull), Ferrybridge (Yorkshire Power Co.), North Tees (N.E.S. Co.), Battersea Corporation, Croydon, Chadderton (Oldham), Derby, Lister Drive No. 3 (Liverpool), Hartshead (Stalybridge, &c., Jnt. Brd.), Yoker (Clyde Valley Co.), Padiham (Lancs E.P. Co.), Leicester. Of the traction stations the three belonging to the London Passenger Transport Board—Greenwich, Lots Road and Neasden—all were better than 20 per cent.

The Largest Output

The station with the largest output was Barking B, which generated 876 million kWh at a load factor of 66.6 per cent.—Barking A with 766 million (37.7 per cent. l.f.), and Battersea with 797 million (68.1 per cent. l.f.), being its closest rivals. The only other stations producing more than 500 million kWh were Barton (632 million at 58.2 per cent. l.f.), and Deptford West (587 million at 54.1 per cent. l.f.), Blackburn Meadows and Kearsley were operated at the remarkable load factors of 77.0 and 75.5 per cent.

Good results were also achieved by several smaller steam stations, having regard to output and operating conditions such as Hayle (Cornwall Pwr. Co.), Bury, Bonnybridge (Scottish Central Pwr. Co.), Wallasey, Southport, Atherton (S. Lancs Transport Co.), Wigan, Nelson and Loughborough, each of which headed its group, based on output, for thermal efficiency or fuel consumption.

Eleven oil-engine stations returned efficiencies equal to or better than Battersea at 28.59 per cent. Last year's figure showed nine better than the 27.95 per cent. then attained by Barking B, and individual performances were also improved. The station of the Machynlleth Electric Supply Co., which secured first place for thermal efficiency with 31.78 and for fuel with 0.569 lb. per kWh, had an output of only about 17,000 kWh. Other oil engine stations that passed the 30 per cent. mark were Ponts Mill (St. Austell Co.), Newcastle-under-Lyme, St. Martin's Lane (Charing Cross Co.), and Mary Tavy (West Devon Co.).

As to other kinds of prime-mover, Leek has the largest gas-producer station, which produced over three million kWh (over two-thirds of the total generated by this type of plant) for 1.83 lb. of coal per kWh, as against the average for this type of station of 2.14 lb. Only six stations used town's gas and these generated 600,000 kWh. Fifteen stations operating refuse destructors generated over 55 million kWh, about the same as the year before. In spite of the falling off in the output of waste heat and waste gas stations by some 30 million kWh to 136 million kWh, these generated 0.72 per cent. of the total or more than twice as much as the oil-engine stations.

The net increase in kWh generated over 1934 of 12.42 per cent. was made up of varying amounts in the different regional areas. Apart from the south of Scotland, where the starting up of hydro-electric schemes gave an increase of 623 per cent., the greatest advance (17.32 per cent.) was made in the north of Scotland. S.W. England and S. Wales was next with 15.56 per cent., while the Central, East, and South-East regional areas all showed over 14 per cent. The average was lowered by the 11.57 per cent. of South-East England, the 10.16 per cent. of Central Scotland, and the 8.54 and 8.33 per cent. of North-East and North-West England, in which areas nearly two-thirds of the electricity sold was generated by about half of the number of power stations in operation.

A Voltage-drop Calculator

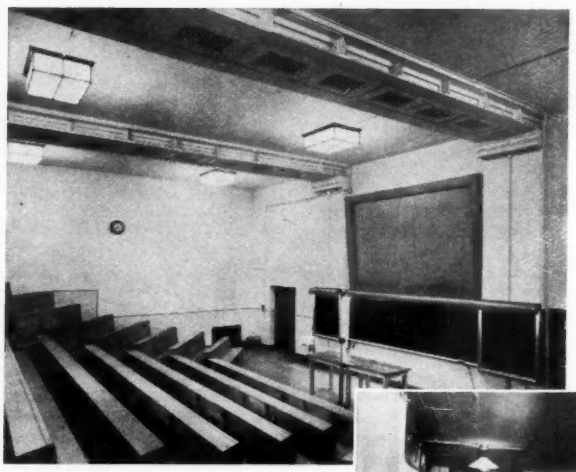
A booklet issued by British Insulated Cables, Ltd., contains data relating to the current-carrying capacities of rubber and paper-insulated cables for normal situations as prescribed in the I.E.E. Regulations. In the back cover is a slide rule for calculating the voltage drop and size of cable with instructions for its use.

Bart's Medical College

The electrical system and special lighting arrangements

ALTHOUGH the new Medical College for research and for the teaching of pre-clinical subjects was opened only recently, students are known to have attended St. Bartholomew's Hospital as far back as 1667, when a dissecting room, laboratory and museum were provided for their use. The school itself was formed in 1821, and upon its centenary obtained a charter. It now has a separate home in the Old Charterhouse School, to which new buildings have been added.

A three-phase supply at 400/230 V from the mains of the County of London Electric Supply Co., Ltd., is brought into a main intake chamber in the basement of the physics block, from which it is distributed to an intake chamber in the basement of each of the four blocks, except the bio-chemistry section, where the control room is at ground level.



The physiology block on the ground floor includes two main lecture theatres and a new research laboratory. The physiology lecture theatre is equipped with a screen suitable for back projection, which is also used for the pharmacology theatre. The greater part of the first and second floors are occupied by research rooms, and on the third floor is the Great Hall, originally the hall of the Merchant Taylors' School.

The supply of electricity to this block is controlled by a contactor switch feeding the sub-circuits. Two 200-V rectifiers supplying d.c. for research purposes are installed in the basement, and a 100-V rectifier with smoothing choke is in the projector room for operating the projector lanterns and cinematograph epidiascope.

The chemistry block is controlled by main and subsidiary switch-fuses governing circuits to the various floors. A rectifier supplies the projector lantern in the lecture theatre at 200 V d.c. and a number of power points in the laboratories. The bio-chemistry building is entirely new, consisting of one floor only. Lighting and power for experimental purposes are distributed in the same manner as in the blocks previously mentioned.

Situated immediately over the main intake which controls the supply to the whole of the college is the physics block. In addition to the a.c. supply circuits, there is also a 200-V rectifier. A large number of 12-V a.c. bench plugs, supplied from small local transformers, are fitted in the research laboratories.

There are two sections in the anatomy block, namely, "Anatomy New" and "Anatomy Old," the former consisting of a dissecting room, lecture theatre, projection room and body store. For operating the d.c. projector in the theatre a 100-V rectifier is installed in the projection room. The old building comprises, on the ground floor, the professors' quarters, museums and X-ray departments, and on the upper floors the histology and biology research laboratories. On the first floor is also the warden's flat. In the intake chamber is installed a rectifier for supplying d.c. at 200 V to experimental plugs throughout the building.

The intensity of lighting has been graded to suit the particular work carried out in each of the various rooms. For instance, in the physiology research laboratories it is 17 ft. candles and in the lecture theatre 15 ft. candles at the working plane. The blackboards, which are equipped with special lighting troughs, are illuminated to an intensity of 30 ft.-candles.

For lighting the physiological lecture theatre six-panel "Hedralite" ceiling units are used to provide good general illumination. Six 75-W lamps with special prismatic reflectors are incorporated in each unit. The "dark" rooms are all equipped with a form of special lighting, which consists of a two-way switch at the entrance door operating either red or white lights carried from a fitting in the ceiling. The master control switch is situated over the developing bench and is so arranged that when the operator in control of the room switches on either the red or white lights it is impossible for anyone entering the room to make any alteration in the lighting.

In the chemistry and physics blocks the average intensity of lighting in the laboratories is from 17 to 15-ft.-candles at the working plane. In the physics lecture theatre a special arrangement of blackboard lighting was necessitated by the use of a window pattern blackboard. This blackboard stands 16 ft. from the floor line, and is so designed that while the professor is writing on the lower half of the board the upper half can be read by the students.

The dissecting room in the anatomy block called for careful attention, as a high but shadowless intensity of lighting was required. Experiments showed an intensity of 23 ft.-candles at the working plane to be necessary, and the actual intensity, obtained by means of two different types of prismatic reflectors, is 25 ft.-candles, the walls being light cream in colour and the floor of red terra cotta. The biology laboratory required 22 ft.-candles; this was obtained by the use of prismatic dispersion reflectors with 300-W lamps at 10 ft. spacing. In the histology laboratory only 15 ft.-candles on the desk tops was called for; the ceiling design enabled close ceiling fittings to be employed incorporating four 60-W lamps and reflectors.

Three sections of the physiology block. 1. The lecture theatre, illuminated by Holophane "Hedralite" fittings with six 75-W lamps and special prismatic reflectors. 2. Intake chamber. 3. Laboratory

Throughout the whole installation, each floor is supplied at single phase, so as to avoid more than 230-V between any two points.

As a number of the rooms are equipped with both a.c. and d.c. points, it has been made impossible to interchange

Meetings and Discussions

Automatic Protection
Arc Weld Stresses
Railway Electrification

Protective Systems Investigated

A STATISTICAL survey of the performance of automatic protective systems was submitted in a paper (Report F/T94) by the British Electrical and Allied Industries Research Association that was read before the Transmission Section of the Institution of Electrical Engineers in London on April 22nd. The paper is a summary of an investigation carried out by the E.R.A. in this country over a period of five years ended 1933, based on a questionnaire circulated to electricity undertakings of not less than 30,000-kVA capacity which are interconnected. There were forty-seven replies, representing about four million kVA of installed generating plant; twenty-one replies were good and detailed, fourteen were useful, and twelve inadequate.

Analysis of the operating results shows that the degree of protection obtained against damage due to faults was of a high order, but continuity of supply has been adversely affected by the operation of protective gear unnecessarily. On the whole incorrect operations due to fundamental causes were few compared with those due to imperfect maintenance or installation errors. During the five years surveyed the general protective efficiency of all types of system applied to generators was 96.5 per cent. on a total installed generator capacity of over four million kVA. The relative proportions of disturbances on networks are shown in Table I and on generators in Table II.

Table I.—Network Disturbances.

Type of apparatus	Percentage of total recorded disturbances	Total incorrect operations expressed as a percentage of total number of disturbances
Generators...	0.61	2.7
Convertors...	0.86	2.1
Transformers	6.34	16.2
Feeders	85.64	76.8
Other plant	6.55	2.2

No opinion is expressed on the relative merits of the various protective systems enumerated, since the relatively small number of faults recorded and the wide diversity of makes employed would make direct comparison misleading. The overall efficiency of transformer protection was 96.4 per cent., but the average percentage inaccuracy for all systems was 41.1, though the data were not as detailed as in the case of generators. The returns for convertor protection mentioned "numerous operations," but detailed records were not available.

Generator and transformer protection appears more settled along relatively well defined lines, whereas in feeder protection there are the largest differences of opinion and a multiplicity of devices appears to be employed under greatly varying conditions.

Table II.—Generator Disturbances.

No. of times protective gear operated	44
Correct operations...	27
Incorrect operations	17
Failures to operate under fault conditions ...	4
Actual faults	31*

* The total number of actual faults is the sum of the total number of correct operations and the total number of failures to operate under fault conditions.

In general, and in the case of feeders in particular, the information contained in the returns was inadequate to enable full conclusions to be drawn at this stage. Fault records are kept by most undertakings, but there is immense diversity in the manner of record-keeping, which renders their comparison laborious and their interpretation uncertain.

It is suggested that all undertakings should use the standard form employed by the Central Electricity Board [Form No. OR (9)] and forward to the E.R.A. a copy of each record, exclusive of faults on l.v. feeders.

* * *

Residual Stresses in Arc-welded Plates

THE magnitude and distribution of the contraction stresses that occur in electrically arc-welded structures are factors of importance which need consideration in the design and fabrication of structures built up in this way.

A paper which Messrs. N. S. Boulton and H. E. Lance Martin, lecturers at Armstrong College, Newcastle-on-Tyne, have submitted (but not read) to the Institution of Mechanical Engineers explains how the authors' experimental measurements have led to the development of an approximate theory by which the residual stresses and strains may be calculated independently of the measured strains. A physical explanation of the way in which the residual stresses originate is thus provided.

The conclusions are that the continuous deposition of weld metal along one or both of the long edges of a mild steel plate produces considerable longitudinal residual strains in the plate. The average longitudinal residual strains, over each of the two gauge lengths adopted, varied linearly across the plate. In the plate in which both long edges were welded simultaneously in the same direction, the residual strain was constant across the plate. Only a small proportion of the residual strain in the plate was relieved when the weld metal was cut off.

At least four-fifths of the width of the plate (measured from the unwelded edge), which was welded along one edge only, remained practically elastic during and after welding. Over this region, the longitudinal residual stress, existing before the weld metal was removed, may be obtained by multiplying the measured strain by Young's modulus.

In the case of the plate with one welded edge, two probable conclusions have been mathematically deduced from the measured strains, namely, (*a*) that the residual longitudinal tensile stress in some region near to the welded edge was in the neighbourhood of the yield stress; and (*b*) that the width

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Bart's Medical College (*Continued from preceding page*)

a.c. with d.c. plugs. This is done by the use of different types of "MK" plugs. All a.c. plugs are coloured black and marked with their load carrying capacity, and d.c. plugs white with similar markings.

In the physics laboratory where, in addition to standard a.c. and d.c. voltages there is also 12-V a.c., the points are equipped with interchangeable two-pin, 2-A, "Dot"-type plugs.

There is a system of intercommunication telephones between the laboratories as well as a number of electric clocks.

The electrical contractors were Electrical Installations, Ltd. Cables were supplied by Messrs. W .T. Glover & Co., Ltd.; general illumination fittings by the Wardle Engineering Co., Ltd.; the special fittings for the lecture theatres and dissecting rooms by Holophane, Ltd.; rectifiers by Messrs. Partridge, Wilson & Co.; and main control switches by Messrs. Sanders & Co., the main boards having been built up by the electrical contractors.

Acknowledgments are due to the Dean of the College, Mr. W. R. Girling Ball, F.R.C.S., in respect of the publication of this article. The architects were Messrs. Lanchester & Lodge, and the consulting engineers Messrs. Handcock & Dykes.

The dissecting room in the anatomical department. The lighting is by 300-W Holophane "Industrial" units

of parent metal, which was plastically strained beyond the elastic limit during welding, equalled, or more probably exceeded, 0.88 in.

According to the theory developed, as the heat from the travelling arc penetrated into the plate, the steel near the welded edge, being unable to expand freely, sustained a high compressive stress under which it yielded plastically. At some instant this plastic yielding penetrated into the plate a maximum distance, beyond which the steel behaved elastically throughout. During subsequent cooling, the plate strained elastically, except near the welded edge where the material became stressed to the tensile yield point. The residual strains, calculated from the theory, agree approximately with the corresponding measured values.

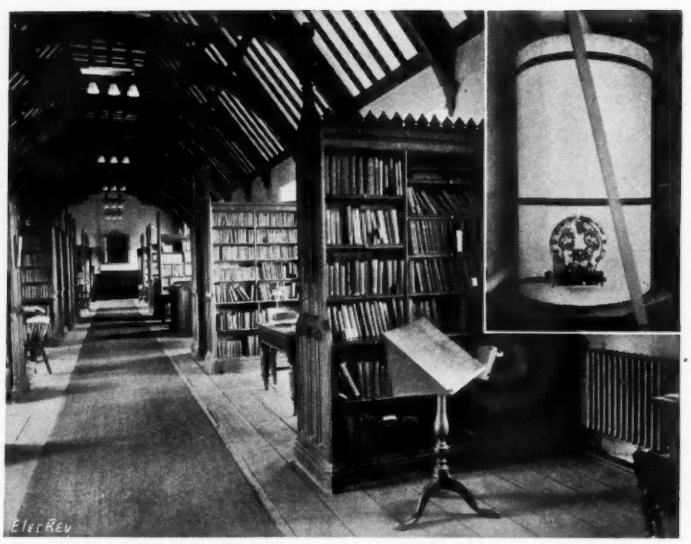
In both plates the theory indicates that a width of about ¾ in. from the welded edge was, after cooling, stressed in tension to the yield point (17 tons per sq. in.). Also, all longitudinal elements within about 1.4 in. of the welded edge were, at some time during welding, strained beyond the elastic limit. An obvious consequence is that, if the plate were loaded so as to produce tension in and near to the weld metal, plastic and not elastic strain would occur. The ordinary elastic methods of calculating the loading stresses would not therefore apply. The theory indicates that in plates wider than those used in these experiments, the width of the plastically deformed region would be greater than in the experimental plates.

The investigations described in this paper were confined to the effects of depositing weld metal along the edges of flat plates which were free from any restraint. The welding of one plate to another plate of different thickness along two opposite edges may produce large transverse residual tensile stress (acting perpendicular to the welded edges) which did not exist in the authors' experimental plates. In this case longitudinal stresses would probably exist, in addition to transverse tension.

* * *

The Case for Electric Traction

IN the course of a paper read before the Manchester and District Traffic Association on April 16th at Manchester, Mr. R. Brooks, manager and chief engineer of the Traction Department of the Metropolitan-Vickers Electrical Co., Ltd., dealt with the traffic and operating aspects of railway electrification. He described electrical operation as a "new tool" wherewith traffic officers might be enabled effectively to solve many of the new and difficult problems which modern transport conditions had thrust upon them.



St. John's College library warmed by a thermal storage installation. Inset is the water-heating tank (See page 591)

The suitability of the electric locomotive for railway work was due to the relatively unlimited supply of energy available from the power system and inherent high overload capacity, which enabled it to exert a torque corresponding to several times its normal rating for considerable periods. The uniform turning effort permitted of working much nearer the adhesion limit than with a fluctuating torque, while steep characteristics provided increase in torque without excessive fall in speed.

Very much higher mileage might reasonably be expected from electric locomotives than from other types of tractor. Practically no preparation time was required before an electric locomotive could take up its turn of duty. Lubrication services were largely automatic for long periods, and there was no equivalent to the fire-cleaning and boiler-washing needed by steam locomotives. The amount of shed time was very small comparatively, and as a result annual mileages were high and maintenance costs correspondingly low.

The author quoted examples of typical results that could be obtained by electrification, but did not necessarily imply that every section of railway was ripe for electrification. He thought that it could be said, however, that when a project had been properly investigated and shown its suitability great benefits had resulted to the traffic operators, and in several instances electrification had proved an adequate alternative to the costly operation of doubling or regrading whole lines of railway.

A lively debate followed. Mr. F. V. Wheddon, district passenger manager, and Mr. A. Bushwell, assistant district superintendent, both of the London and North-Eastern Railway, referred to the forthcoming electrification of the Manchester to Sheffield line. If it was successful, they said, it would give a lead to the whole country, for that line was said to have the heaviest density of goods traffic of any line in this country.

The supposed vulnerability of power stations to aircraft attack, and the possibility that floods might cause dislocation were replied to by the author.

* * *

A.C. Commutator Motors

THE variable speed a.c. commutator motor (Schrage type) and its applications was the subject of the paper, by Mr. R. D. Given, which was read before the Association of Supervising Electrical Engineers in London on April 21st. The author pointed out that the no-load speed of a machine of this type is variable and the change of speed is small for a given change of load. This result is achieved by introducing an adjustable e.m.f. of the correct value and frequency into each phase of the rotor circuit in opposition to the induced e.m.f., so that at the no-load speed these forces balance; under load the induced voltage preponderates, due to slip by an amount sufficient to drive the requisite load current through the rotor windings.

The Scherbius motor has an auxiliary machine of the commutator type, which is electrically connected to the rotor of the induction motor, and by means of suitable control gear and variation of the excitation of the auxiliary machine, can vary the speed of the induction motor in this way. But the arrangement is somewhat complicated and expensive, and one of the merits of the Schrage motor is that the whole of the action is embodied in the motor itself, which is the same in principle as an ordinary induction machine, but the primary winding is carried on the rotor and the secondary on the stator, which is the reverse of the arrangement of an induction motor.

The cables for the supply are connected to brushes which bear on three collector rings from which leads are taken through a hole in the shaft of the primary winding. In addition, there is placed above and in the same slots of the rotor, a regulating winding which is connected to the commutator, and by means of brushes on the latter, direct to the secondary winding on the stator.

There are two sets of brushes, each carried in boxes mounted on a rotatable steel ring. The two rings are each provided with a rack, which engages with a pinion mounted on a spindle, one for each rack, inside the arm of the end frame, and the two spindles are coupled externally by two pinions. One of the spindles projects far enough to take a hand wheel or a gear drive, by means of which the spindles, and hence the brushgear, are moved for smooth and stepless speed changing.

* * *

Motor Breakdowns

The characteristics and performance of alternating-current motors formed the subject of a recent lecture given by Mr. D. D. Rayner to the Chester Engineering Society, in which the author stated that the greater proportion of motor insulation breakdowns was due to incorrect switching, either at starting or when speed changing. This point depended on the load on the machine and was often apt to be overlooked when equipment was installed. Power factor was discussed and the advisability of using high-speed motors wherever possible was stressed. The paper was illustrated by slides and performance curves.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Maximum kVA Demand

In your issue of April 10th Mr. G. W. Stubbings introduces us to a novel method of assessing maximum kVA demand charges based upon a measured kW demand and converted to kVA by determination of the average power factor obtained from the registrations of kWh and kVARh meters.

Expediency comes to your contributor's assistance in no small measure, and through such he evolves a formula which his consumer's accountant will agree is convenient. Does he assert that his consumer's principal will be so beguiled by the simplicity of his method as not to seek an explanation? And if a desire for the removal of obscurity is shown, is his consumer to find the relationship between sec $\phi - 1$ and tan ϕ a simpler proposition than the trigonometry of a right-angled triangle?

The introduction to the article naturally led to the measurement of kWh and kVARh, but it might not be out of place to point out that a kVA demand assessment based upon a current measurement and the circuit constants does not of necessity lead to a cure, from the supply point of view, of the effects of bad power factor.

Let us consider a consumer who has installed static condenser plant for power-factor correction. A simple demonstration convinces him that the condenser losses are negligible and the load factor of this apparatus immediately becomes 100 per cent. What now are the running conditions? A corrected power factor of, say, 48 hours and a zero power-factor load of condenser magnitude for 120 hours per week. Consideration of the simple case where power-factor correction has been carried out from 0.5 to 0.86 will show that the losses before and after correction are in the ratio of 6 to 7.

It would appear, therefore, that some penalty must be introduced to take care of the kVARh, and to that extent I am in agreement with your contributor. S. W. HAZELL.

London, N.W.7, *April 17th.*

Small Single-phase Motors

In reply to Mr. P. S. Firmin's letter in your issue of April 17th on single-phase synchronous motors, I think we have in mind two somewhat different types. His remarks about output are correct where the machine is run with a condenser permanently in circuit.

If, however, a split-phase machine is under-rated to the extent mentioned in my article, namely, 33 per cent., it will be found that the rotor will pull into step on the running winding alone after the starting winding has been disconnected by a standard centrifugal switch. E. K. BOTTLE.

Birmingham, *April 17th.*

A Tariff Inquiry

I am anxious to collect as much information as possible on the subject of electricity tariffs for domestic, business and institutional premises, and should be grateful if any of your readers would send me details of any interesting or novel tariffs which they may have come across.

The particular points I have in mind are these:—Methods of assessing the primary charge of two-part tariffs; off peak tariffs, with details of the restrictions imposed; space heating tariffs, with particulars of what apparatus must be used to qualify for them; "penalty tariffs," with details of restrictions; and multi-rate metering tariffs.

I need scarcely add that any information received will be treated as confidential, and if correspondents desire to omit the unit charge it will not affect the value of their replies, as it is the *methods* of charging in which I am interested.

5, Bloomsbury Square, W.C.1, *April 20th.* HAROLD BRIGHT.

Earthing and Testing

Mr. G. E. Moore's invitation to a bath is not at all sporting. He asks me to take an odds-on risk, whereas I am arguing about one of a billion to one against. That is about the chance of a fatality in an average electrified bathroom and I am as willing to take it without the protection of Regulation 1002 as I am to cross a road without that of a Belisha beacon. "We are governed too much" (Artemus Ward), and presently we shall all have to wear gas masks when we visit our quadruplets (see recent pictures in the popular Press).

I'm afraid Mr. Moore has missed my point in comparing gravity with electricity. It is that if we can accept easily, as we do, the dangers of gravity simply because they are familiar to us, why panic about the lesser dangers of electricity, which is a natural force (not, by the way, "man-made") no more mysterious than the other? It is, to say the least, bad propaganda.

Anyway, Mr. Moore in all his letter has said nothing to disprove my contention that Regulation 1002 is "unpractical" because its application would not be tolerated in a decent bathroom; by which—I refer him to my original article—I don't mean the sort of "scullery-bathroom" that he evidently has in mind all the time. H. R. TAUNTON.

Tatsfield, Surrey, *April 20th.*

Abstruse Papers

Why should "Lowbrow Graduate" in your issue of April 3rd taunt the M.I.E.E.'s with inability to understand many of the papers read before the Institution. These men qualified by the standard set at the time of their election. The writer of the letter should realise that passing the Graduate examination is only the start of his learning (in some professions there are many examinations to pass, not one).

The main object of the I.E.E. is to advance the cause and science of electricity, not retard it to enable the stragglers to catch up; hence the papers read must be reports of investigations carried out so that there is a basis for those who have the knowledge to promote future progress both on the practical and theoretical sides.

I smile at the tolerance with which lack of mathematical ability is accepted—often men seem proud of their "lowbrow" maths. Can "Lowbrow Graduate" suggest a remedy which has not been tried already? A.M.I.E.E.

April 12th.

The Meter Engineer's Status

I was very pleased to note from "E. C. M.'s" letter in your issue of April 17th that at least one undertaking recognises the necessity and exceptional usefulness of the skilled meter and testing engineer. It is to be greatly deplored that more high-placed officials in the electricity supply industry cannot see the fundamental point that accurate meters mean maximum revenue for units generated.

Although associated with a company with more than the average testing and repairing facilities, I find that the financial control authority classifies this work as being of little more importance than that of the casual worker if the emoluments are to be accepted as the basis of the undertaking's recognition of such work.

A great deal of discontent and slipshod workmanship is due to men in identical positions being paid greatly varying wages and salaries which is definitely unsatisfactory. It seems strange that many so-called commercial men should fail to observe this elementary problem of finance, or perhaps they do not wish to see it.

My experience is that a capable testing engineer must have a good grounding and acquaintance with all sections of the supply industry, and he should be recognised as an official of some importance and paid accordingly. H.

April 20th.

Your correspondent "E. C. M." is, of course, perfectly right in his contention that very few meter engineers either enjoy the recognition and status to which they are justly entitled, or are afforded an opportunity of extending their usefulness into really profitable channels.

There can be no question, too, but that the absence of a definite grade for meter engineers under the N.J.B. Schedule constitutes a serious obstacle in any attempt to put matters right, inasmuch that by virtue of such exclusion from the designated positions set out therein those responsible for framing the schedule have to all intents and purposes technically admitted that the post of meter engineer carries no important significance whatever and may, in fact, quite safely be left to take care of itself. This being so it is at once fairly apparent that very little in the way of practical sympathy or consideration is likely to be extended to the meter engineer from a more immediate source with the result that this unfortunate individual is, generally speaking, not only left at the mercy of his "chief" as to what salary he is to receive in return for his services, but is more often than not deprived of many of the privileges enjoyed by his colleagues in other departments whose salaries and conditions of service are for the most part clearly defined and governed by the N.J.B. agreement.

Why such a perfectly obvious and glaring anomaly was ever permitted in the first instance, and, worse still, allowed to stand, has yet to be satisfactorily explained, and while it may be argued that other (at present) undesignated positions

have an equal right to a claim for a place in the schedule, or that the existing machinery is sufficiently adequate to deal with all matters affecting the meter engineer's interests, experience has shown that the non-designated position in general does undoubtedly suffer from that lack of uniformity to which "E. C. M." refers, and it is this disquieting factor which gives rise to so much criticism and dissatisfaction. As matters stand at the moment, however, and unless those responsible for the application of the schedule can be prevailed upon to remove the anomaly, there would appear to be no immediate redress.

It is true, of course, that a practical solution might be found to be in the establishment of an entirely separate protective organisation, but such a measure has obviously little if anything to commend it from a sane common sense point of view, and at the most would, it is feared, only serve to increase the difficulties of securing for the meter engineer that degree of recognition so essential to his progressive development.

HOPEFUL.

April 20th.

I would like to comment upon one point in "E.C.M.'s" letter which, in my opinion, is not good practice. I refer to item (a), the latter half of which reads:—"Test rooms preferably situated on the top floors of buildings, and not in basements."

Though agreeing in the main with the points raised, I am of the opinion that test rooms should neither be in basements nor on top floors. The correct practice, undoubtedly, is a substantial building on ground level, one storey high, with solid foundations, windows evenly distributed on all sides, and without interference from surrounding buildings. The layout of building should be sectionalised as follows:—All meters, instruments, transformers, &c., returned from circuit received at one end of the building to be racked in classified order. From this section all stock that requires external cleaning and painting should be drawn, ready for entry into the repair and overhaul section. After this instruments should be racked ready for the testing and recalibrating section, finally passing into the testing room, and when completed again racked ready for distribution.

An objection to top floor test rooms is double transport, which, whether by lift or manual labour, is a waste of time—more so if the building is three or four storeys high. Vibration is also a factor in top storeys, especially where a fair sized motor-generator is in use, and however substantial the building is it cannot be compared with ground level solidarity for delicate testing.

Basement test rooms are obviously wrong, mainly from the light point of view, although the question of transport also arises, though not to such a great extent as with top floor test rooms.

F. W. HARDING.

Llanelly, *April 21st.*

The Load Incidence of High-class Flats

I have read with great interest the article in your number of April 17th concerning load incidence of high-class flats. There is one figure in this article, however, which I cannot quite understand. If I follow the author correctly, each of the fifty-seven flats in this block has an electric refrigerator, and I cannot see how the connected refrigerator load comes to 6 kW only.

R. KAUFFMAN.

London, W.C.1, *April 18th.*

[Mr. I. B. Walker informs us that apparently only thirty 200-W refrigerators are at present installed. He also states that the recording summation ammeter referred to is a standard "Cadet" grapher made by Messrs. Everett, Edgcumbe & Co., Ltd., with a special arrangement of the three current transformers and rectifiers to enable the total current to be recorded by the grapher.—EDS. ELEC. REV.]

New Books

A Class Book of Magnetism and Electricity. By H. E. HADLEY. Pp. 512; figs. 432. London: Macmillan & Co., Ltd. Price 6s. 6d.

There are so many excellent text-books dealing with magnetism and electricity suitable for secondary and junior technical schools that some justification is required to warrant the publication of another. The majority of boys studying the subject, although they may regard it merely as a part of the curriculum and one of the subjects in which they must pass for matriculation or the General Schools Certificate, are interested in electricity for its own sake, and many of them are doubtless ambitious to become electrical engineers—whatever that extremely comprehensive term may convey to them. Anyway, while keeping the examinations mentioned in mind, Mr. Hadley has given them a book which explains simply and, where possible, in its correct relationship to the appropriate part of the syllabus, the practical applications of electricity which the observant boy daily sees around him. Thus, in dealing with the heating effect of an electric current, reference is made to radiators, electric furnaces and fuses. At the conclusion of the book are four chapters on radio activity, electrical communication, wireless and sound recording, including talking films, which, we imagine, the majority of boys will want to read long before they have studied the more orthodox parts of the book.

The author works thoroughly through the entire syllabus of the examinations referred to above, although, in order that the impatient student may not be discouraged by what may seem an academical study of theoretical principles, he rearranges the usual order of the different parts, the first two chapters being devoted to a general account of the properties of electricity and magnetism with which he may be already more or less familiar. Ultimately, however, magnetism, static electricity and current electricity are all dealt with, and at the conclusion of each chapter there is a collection of exercises, typical examples being completely worked out.

Intermediate Engineering Drawing (Pp. 170; figs. 302. Price 7s. 6d. net) and **Engineering Workshop Drawing** (Fourth edition. Pp. 116; figs. 237. Price 4s. net). By A. C. PARKINSON. London: Sir Isaac Pitman & Sons, Ltd.

The first-mentioned book has been prepared especially for students preparing for the Engineering Drawing and Design Examinations of the University of London (Intermediate B.Sc. (Eng.)), the Civil Service Commissioners (G.P.O.), and the second year of National Certificate courses. It is arranged in three parts:—I, Conventions and Geometry; II, Engineering Drawing; III, Exercises.

The thirty-six pages occupied by Part I contain much matter which should have been covered in a preliminary course, and presumably its inclusion in the present volume is due to the subjects coming within range of the syllabuses of the above examinations. The major part of the book (100 pages) is devoted to engineering drawing and design, but the "design" is treated from a very elementary and theoretical aspect, and involves principally the application of formulæ to numerical examples. Thus, when dealing with shafts, the diameter is worked out on the basis of twisting alone, and no comments are made on the limitations of the formula in practice. This is not a desirable procedure in a book intended for students preparing for an engineering degree. The final part contains drawing exercises and questions from appropriate examination papers. These exercises are devoted entirely to mechanical engineering. The drawings and sketches, however, are good. Items dealt with include screw threads; bolts, studs and stays; rivets and riveting (including a short paragraph on welding); shafts, keys and cotters; couplings; belts and pulleys; pipes and pipe joints; valves; engine parts; toothed gearing.

The book on the whole can be considered to fulfil its object, although it adds little, if anything, to existing literature available. The diagrams and drawings are well reproduced, and the student who wishes to acquire the technique of good draughtsmanship could not have better examples to work from.

That the second book has run through three editions during the past six years is sufficient testimony of its usefulness in technical colleges and junior technical schools. In this fourth edition the author has improved the reproduction of a number of illustrations and made minor emendations to the letterpress. The book can be thoroughly recommended to the young engineering student and apprentice, who apparently is assumed to have little or no knowledge of plane and solid geometry, loci and conic sections.

* * *

Shorter Notices

"Factory Administration in Practice," by W. J. Hiscox and J. R. Price. (Third edition.) Pp. 294. London: Sir Isaac Pitman & Sons, Ltd. Price 8s. 6d. net.—The preface to this new edition states that the scope of the book has been widened by the inclusion of a chapter on the organisation and administration of labour within the factory. Apart from this the original matter has been left undisturbed.

"Einführung in die Angewandte Akustik," by Dr. H. J. Von Braunmühl and W. Weker. Pp. 216; figs. 154.—Leipzig: Verlag S. Hirzel. Price Rm.920.—This introduction to applied acoustics deals with the problems of sound measurements, transmission and recording. Certain aspects which are hardly out of the laboratory stage are only mentioned in passing, as the authors take a broad general view of the subject. Many graphs and explanatory diagrams are included, and there are chapters devoted to microphones and loud speakers and natural resonance.

"Mathematics of Modern Engineering—Vol. I," by R. E. Doherty and E. G. Keller. Pp. 314; figs. London: Chapman & Hall, Ltd. Price 17s. 6d. net.

"The Testing of Internal Combustion Engines," by S. J. Young and R. W. J. Pryer. Pp. 200; figs. 87. London: English Universities Press, Ltd. Price 8s. 6d.

New Apparatus and Devices

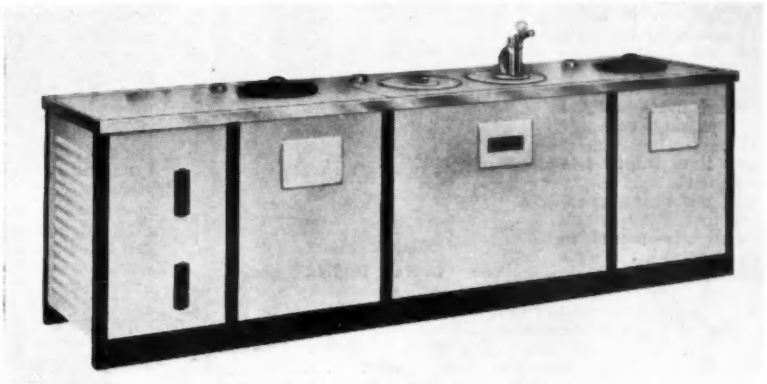
for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Refrigerated Milk Bars

Milk bars are relatively new to this country, but there is a growing market for the type of automatic electrically refrigerated equipment introduced by MARCO REFRIGERATORS, LTD., Manor Works, Rowan Road, Streatham Vale, London, S.W.16, and LEDA ELECTRIC, LTD., Morden Road, Mitcham.

The Leda model holds two milk sleeves, each fitted with a four-gallon churn, while there are four-gallon ice-cream containers on each side of the milk-holding section. The whole outfit is in the form of a counter, and is supplied together with a battery of six syrup containers. The sections can be obtained separately.

The "Marco Purytan" milk bar is 3 ft. 8½ in. high by 6 ft. 10½ in. long by 2 ft. 10½ in. deep. It has a one-piece working counter 2 ft. 6 in. high, and a serving counter 3 ft. 8½ in. high. The framework is of dried timber insulated with slab cork set in hot non-odorous bitumen, and the exterior of the bar consists of porcelain-enamelled steel sheets in two colours; the one-piece porcelain-enamelled counter top is 2 ft. 6 in. from the floor, and is fitted with two milk pumps and two plugs for mixers. The counter has eight porcelain syrup jars and adjustable stainless steel syrup pumps, with a disher well at each end of the pump rack.



The "Leda" refrigerated milk bar showing, left to right, the machine compartment, ice-cream storage sleeve, milk-cooling section and ice-cream storage sleeve

The six five-gallon churns are accommodated under the counter and are "dry-system" cooled by a brine surround, the sides being constructed of corrugated galvanised steel to ensure the maximum cooling surface. The floor of the compartment is so constructed as to enable the churns to be removed or replaced without having to be lifted.

Two four-gallon ice-cream storage sleeves are also provided. These are placed directly into the calcium chloride brine and cooled by copper direct-expansion coils.

The counter top is provided with two stainless steel milk pumps fitted with an agitating device operated by a lever handle. This arrangement is designed to fill an 8-oz. glass with one stroke.

A twin-cylinder (model YT) air-cooled vertical reciprocating compressor is connected to the cooling coils fitted in the brine tanks. Methyl chloride is the refrigerant, and the compressor is driven by a ½ h.p. motor, the operation of which is thermostatically controlled by the temperature of the brine.

"Coldair" Refrigerators

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has completed arrangements whereby it will distribute the "Coldair" electric refrigerators referred to in the article dealing with refrigeration published in the ELECTRICAL REVIEW of April 17th.

A Locking Connector

The "Readylock" is a simple device for locking two detachable members together so that they cannot be separated by a direct pull. The locking mechanism consists essentially of two metal stampings which, for electrical purposes, are made of spring copper or phosphor bronze so proportioned as to provide a liberal contact area.

The design is applicable to radio detachable connectors, domestic plugs and sockets and the electrical equipment of motor-cars, but it can be used in any size from the necklace-clasp type to that suitable for towing-bar couplings. The device, for which a number of further possible applications are under investigation by its inventors, has been developed by READYLOCK, 20, Copthall Avenue, London, E.C.

"Fibracork" Jointing

In addition to "Vellumoid" sheet jointing MESSRS. CHILLCOTTS, LTD., 1, Trinity Place, Trinity Street, Borough, London, S.E.1, now make "Fibracork," which consists of high-quality cork sandwiched between two layers of a special petrol- and oil-resisting jointing material that adds to the strength of the cork and effectively guards against any risk of disintegration.

"Fibracork" is intended principally for use where extra resilience or cushioning is required, and is made in any thickness from $\frac{1}{32}$ to $\frac{1}{8}$ in.

A Pad Handle for Hacksaw Blades

When, owing to restricted space, a hacksaw blade fitted in its proper frame cannot be manœuvred effectively, use can be made of the "Eclipse" pad handle manufactured by MESSRS. JAMES NEILL & CO. (SHEFFIELD), LTD., Composite Steel Works, Napier Street, Sheffield, 11. The blade is fixed in the durable aluminium alloy handle by means of a clamping screw. Even a broken blade can be used in this way.

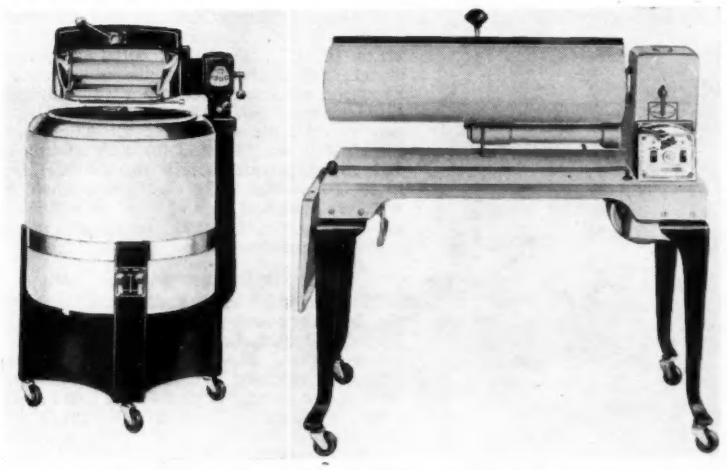
Laundry Equipment

The "1900" electric washers and ironers are among the new products marketed by UTILITIES (LONDON), LTD., 1, Newman Street, London, W.1. The "Standard Six" washer has a vitreous enamelled steel tub taking 6 lb. of dry clothes. The high-speed agitator is designed not to grip the clothes, and the ¼-h.p. motor is rubber mounted and automatically oiled. The wringer has a high sided draining board and 2¼-in. "balloon" rollers.

A 45 per cent. larger agitator is incorporated in the "Super Eight" model, which has a clothes capacity of over 8 lb. The tub is white enamelled inside, with a ribbed chromium splash ring and a chromium-plated aluminium lid, while features of the wringer are the bar release and interlocking head. Both the above models are finished in ivory picked out with red.

The attractive appearance of the *de luxe* model is due to its streamline construction and its colour scheme of black, ivory and chromium. This machine, which has a similar capacity to the "Super Eight," incorporates a number of additional refinements, and, as in the cheaper models, all the mechanism is fully enclosed and silent in operation.

The highly polished chromium-plated ironer is designed to obviate any possibility of stain or rust marks or scratching, and its shoe adjusts itself automatically to buttons, pleats, seams, etc. Both hand and knee controls are conveniently situated, and the clothes bar and extension shelf provide useful extra space. A red lamp indicates when the current is switched on. The heating element has a loading of 1,100 W and the motor is rated at 290 W.



The "1900" streamline washing and ironing machines

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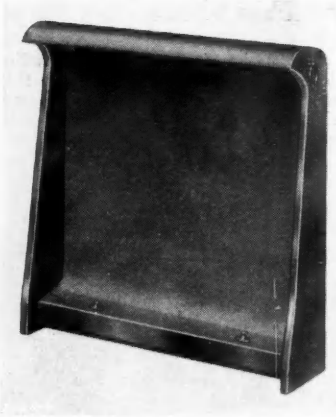
A Combined Radiator and Convector

Uniform warmth is claimed to result from a combination of radiated and convected heat provided by the new 2-kW "Bi-Heat Duplex" heater made by MESSRS. BERTRAM THOMAS, Worsley Street, Hulme, Manchester.

The elements are situated inside a metal casing, the front panel of which acts as a radiating surface. The heat from this panel, the temperature of which is kept low in order to minimise the risk of scorching neighbouring objects, is supplemented by convected heat obtained by passing cool air through the casing at the bottom over the elements and out at an opening in the top, which is slightly curved to deflect the air forward.

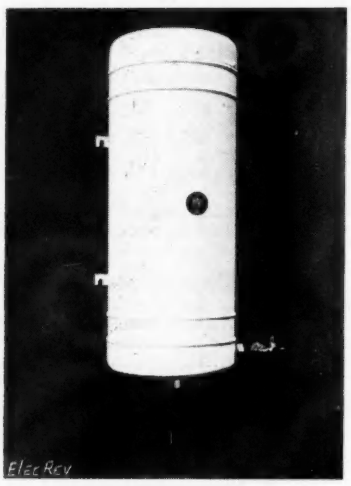


The "Bi-Heat Duplex" heater

Two switches control the three rates of heating, a luminous indicating device showing when the heater is switched on. There is an earth wire for the casing, and lifting rings at each end facilitate moving the heater from one room to another. A variety of coloured finishes is available.

Electrode Water-heaters

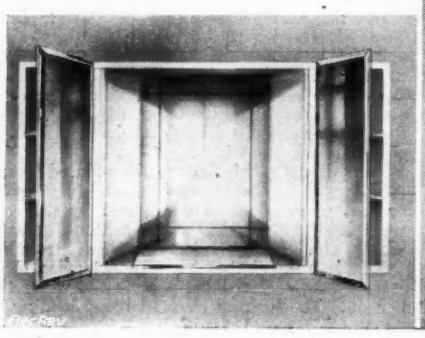
The domestic electrode water-heaters of MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne, have recently been improved in design. The heaters are cylindrical and have dip-tinned copper inner containers that are now tested to a pressure of 120 lb. per sq. in. and fitted with brass apparatus plates carrying elements of a lower loading per square inch than the previous types. The outer case is of sheet steel, separated from the inner casing by cork lagging. Slotted brackets are fitted, suitable for wall-mounting, and the whole exterior is finished with stoved white cellulose enamel. The magnetic thermostat has been made adjustable and has a scale calibrated between 100 and 190 deg. F., while the elements can be removed from the heater without draining off the water. Models of from 1½ to 20 gal. capacity are available, and in the displacement type an anti-siphon and non-return device are now incorporated.



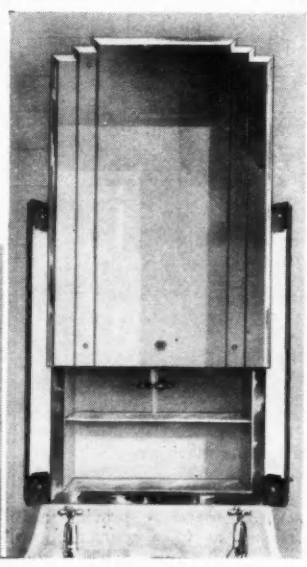
A Reyrolle water-heater

Illuminated Mirrors

Electrically illuminated mirrors are now being produced by DOWNHAM & CO., 46, Auckland Street, Vauxhall, London, S.E.11. Several types are available, designed to take strip and ordinary pearl lamps. Some are in the form of cabinets with the doors mirror-faced, a special model of this kind being the "Miro-Glide" recess cabinet and splash back for fitting over wash-basins. It incorporates illuminated side panels and an electric clock, the mechanism for raising the mirror front to reveal the shelves being operated on the counterweight system.



The Model 184 cabinet-type illuminated mirror and the "Miro-glide" recess cabinet and splash back



An Improved Boiling Plate

The oval boiling plate of the REVO ELECTRIC CO., LTD., Tipton, Staffs, is now fitted with the new four-heat switch. The boiling table consists of the same rigid cast frame designed to accommodate one, two or three pans. The 8 in. diameter four-heat plate has a maximum loading of 2¼ kW, the intermediate loadings being 1½ and ¾ kW, and that for simmering ¼ kW. The heat is distributed evenly over the plate whatever the position of the switch. The finish is vitreous mottled grey enamel, and the equipment includes two yards of three-core flex.

The four-heat Revo boiling plate

A Breakfast Cooker

Apart from the hob, which is of fine grain vitreous-enamelled cast-iron, the body of the new B. & Y. breakfast cooker (No. 3A) is of mottled grey enamelled steel. The element takes the form of a griller boiler of the same type as that fitted to the larger cookers. It is loaded at 1,800 W and is controlled by a three-heat rotary switch. The standard equipment includes a grill-pan, grid, non-tip rack and deflector plate and two yards of three-core flexible cable. The makers are MESSRS. BERKELEY & YOUNG, LTD., Tyseley, Birmingham, 11.

The "B. & Y." No. 3A cooker

"All Wave" Radio Receivers

A new range of "Fidelity" all-wave receivers has been designed by the GENERAL ELECTRIC CO., LTD., Kingsway, London, W.C.2. They are for operation on a.c. mains (100/150, 200/250 V, 40/80 cycles), and models will shortly be available (1) with a European stations dial covering wavelengths of 16/98 metres, 200/550 metres, and 800/2,000 metres; (2) with an "overseas" dial covering similar wavelengths; and (3) with an overseas dial covering continuously wavelengths from 16 to 550 metres. The eight-valve (including rectifier) chassis of each of these models is contained in a solidly built walnut cabinet of attractive modern design.

Electric Ironers and Washers

The "Easy" washers and ironers, which are sold in this country by RHODES BROS., 21, Liverpool Street, London, E.C.2, are made in several forms. Models 2DS and 1B utilise a patent "Spiralator" action, the former containing also a damp dryer and the latter a dual-release wringer. Type 2U incorporates a vacuum cup washing action. Two low-priced models are made, utilising a "Turbolator" washing action and they are fitted with electrically driven safety wringers. In all cases an optional extra is an electric pump for emptying the water. In addition, there is a range of ironers, from the small model 20 for fitting on to an electric washer, to the model 60 folding table top design.

British Overseas Electrical Trade

Machinery exports up 51 per cent. on March last year

AT £1,283,164 our electrical exports in March were £251,593 better than in the corresponding month of last year, which had an equal number of working days, the 24 per cent. improvement being substantially above the average for the past twelve months. Indeed, the electrical section constitutes one of the "high lights" of the Board of Trade returns for the month, the general increase in exports of British goods being only 1.5 per cent.

At the same time, it is perceived that many of our foreign markets for electrical products are becoming less and less remunerative. For instance, Russia, which used to be a valuable customer, has no separately classified entry in the March returns, while shipments of goods and apparatus to Italy amounted to only £998 compared with £19,257 in March, 1935. Altogether, eight foreign countries, as well as the Irish Free State and Canada, took less of our electrical goods and apparatus than in the corresponding month of last year. Happily, however, there were largely increased shipments to Empire markets. In addition, France has lately been importing more from us, and a further large expansion in this direction is recorded, namely, from £11,841 to £31,423. It is interesting, too, to observe that shipments of goods to Brazil last month were nearly five times as much as in March, 1935. In an article which appeared in the ELECTRICAL REVIEW of March 6th it was stated that this country presents a market for certain types of electrical household appliances.

Machinery exports have assumed greater prominence in recent months, and in March the value of such exports advanced by 51 per cent. over March, 1935, and in the "other machinery" section the growth was 72 per cent. Not since the economic depression has the value of machinery, excluding motors and generators, risen so high as £293,584.

There is still an improving demand for wires and cables, and the following figures, which do not include telegraph and telephone cables, indicate the chief destinations, comparative figures for March, 1935, being given in parentheses:—

Rubber insulated wires and cables.—Australia, £30,068 (£23,957); South Africa, £23,665 (£15,354); British India £14,995 (£14,721); New Zealand, £9,071 (£4,138); other British countries, £13,666 (£10,054); foreign countries, £8,911 (£10,724).

Electric wires and cables (insulation other than rubber).—South Africa, £27,216 (£30,357); British India, £15,347 (£9,700); Australia, £7,305 (£6,596); other British countries, £20,866 (£16,098); foreign countries, £13,819 (£8,981).

In regard to telegraph and telephone apparatus other than radio, which at £136,077 is the second largest classified item, the principal destinations were:—South Africa, £46,463 (£19,303); Australia, £30,963 (£14,420); Argentina, £18,028 (£22,779); Canada, £1,119 (£860); other British countries, £13,154 (£21,750); other foreign countries, £26,350 (£47,961).

Imports also reveal an upward tendency, the total of £325,579 being £62,913 (25 per cent.) more than in March, 1935. Only in the case of "other radio parts and accessories" was there a decrease, and even then the amount imported (£46,195) was substantially in excess of British exports of the same type, which were of the value of £31,596. The same applies to electrical instruments other than house service meters, with imports of £24,721 and exports of £16,624. Unenumerated electrical goods account for nearly one-fifth of the total imports, two other outstanding classifications being lighting apparatus (£44,006) and electric motors (£35,443).

EXPORTS AND IMPORTS DURING MARCH.

Classification	Exports. March, 1936.	Exports. Inc. or dec. compared with Mar., 1935.	Imports. March, 1936.	Imports. Inc. or dec. compared with Mar., 1935.
Submarine telegraph and telephone cables	£17,054	– £268	*	—
Telegraph and telephone wires and cables (not submarine)	33,390	+ 3,838	*	—
Other insulated wires and cables	184,929	+ 34,299	£27,026	+ £9,136
Radio receivers, not radiograms (excluding valves)	29,847	+ 9,663	24,152	+ 9,586
Radio transmitters (excluding valves)	28,427	+ 12,359	*	—
Radio valves	27,242	– 6,972	20,844	+ 6,470
Other radio parts and accessories	31,596	– 547	46,195	– 1,817
Telegraph and telephone apparatus (other than radio)	136,077	+ 9,004	*	—
Electric carbons	*	—	10,435	+ 1,347
Incandescent lamps	53,729	+ 5,841	11,250	+ 2,399
Other lighting apparatus	44,293	+ 4,580	32,756	+ 10,215
Primary batteries	17,643	+ 6,275	418	+ 202
Accumulators	47,282	+ 9,038	*	—
House service meters	18,049	+ 3,777	*	—
Other electrical instruments	16,624	– 749	24,721	+ 768
Unenumerated electrical goods and apparatus	141,555	+ 7,292	62,394	+ 10,022
Electric generators up to 200 kW	24,348	– 121	*	—
Electric generators over 200 kW	31,721	+ 11,335	*	—
Electric motors	105,774	+ '19,887	35,443†	+ 10,098
Convertors and transformers	97,459	+ 55,553	*	—
Starting and controlling gear for motors	82,246	+ 49,110	*	—
Switchgear	102,378	+ 19,513	*	—
Other electrical machinery	11,501	– 1,114	7,486	+ 2,145
Electric vacuum cleaners	*	—	22,459	+ 2,282
Total	£1,283,164	+ £251,593	£325,579	+ £62,913

* Not classified separately. † Not railway and tramway motors.

The values of imports from various sources, with comparative figures, were as follows:—

Electrical goods.—United States, £72,086 (£46,262); Germany, £61,418 (£59,673); Netherlands, £47,520 (£48,135); Switzerland, £20,461 (£13,727); Belgium, £14,357 (£6,652); France, £9,991 (£11,391); Austria, £5,495 (£9,374); other foreign countries, £15,511 (£9,242); British countries, £13,352 (£7,347).

Electric vacuum cleaners.—United States, £10,248 (£9,779); Canada, £7,720 (£5,464); Germany, £1,183 (£1,058); Sweden, £835 (£449); various other foreign countries, £2,466 (£3,427).

Whereas the adverse balance of British overseas trade as a whole was considerably more in the first quarter of this year than in the corresponding period of last year, the excess of electrical exports over imports increased by about £200,000. Altogether, electrical exports amounted to £3,610,971, representing an increase of £362,267, or 11 per cent., while imports increased by £158,502 (22 per cent.) to £942,408.

BRITISH ELECTRICAL EXPORTS DURING MARCH.

Destination.	Goods and apparatus, Mar., 1936.	Inc. or dec. compared with Mar., 1935.	Electric generators, Mar., 1936.	Inc. or dec. compared with Mar., 1935.	Motors, Mar., 1936.	Inc. or dec. compared with Mar., 1935.	Other electrical machinery, Mar., 1936.	Inc. or dec. compared with Mar., 1935.
Irish Free State	£24,604	– £3,687	*	—	*	—	*	—
Channel Islands	9,448	+ 651	*	—	*	—	*	—
Union of South Africa	153,940	+ 24,985	£13,966	+ £8,653	£38,615	+ £14,976	£76,961	+ £20,952
British India	105,965	+ 19,237	17,110	+ 8,143	10,869	+ 385	62,913	+ 31,880
British Malaya	21,622	+ 3,442	*	—	*	—	11,535	+ 6,521
Ceylon	13,562	+ 7,043	*	—	*	—	*	—
Hong Kong	25,087	+ 18,812	*	—	*	—	*	—
Australia	119,201	+ 36,875	3,282	+ 866	9,018	– 1,105	21,607	+ 13,620
New Zealand	53,390	+ 9,860	*	—	3,477	+ 1,154	20,400	+ 14,863
Canada	7,501	– 15,487	3,245	+ 3,064	5,057	+ 2,884	3,778	+ 2,092
Other British Countries	48,209	+ 589	9,873	– 5,828	13,674	+ 2,657	23,167	+ 1,062
Sweden	3,924	– 7,084	*	—	*	—	*	—
Denmark	4,539	– 1,392	*	—	*	—	*	—
Netherlands	12,071	– 13,036	395	– 2,709	*	—	635	– 219
Belgium	9,069	+ 567	*	—	*	—	*	—
France	31,423	+ 19,582	*	—	*	—	2,357	+ 180
Portugal	3,973	– 2,996	*	—	*	—	*	—
Spain	3,253	– 3,181	*	—	*	—	*	—
Italy	998	– 18,259	*	—	*	—	*	—
Greece	2,589	+ 123	*	—	*	—	*	—
Rumania	8,399	+ 4,793	*	—	*	—	*	—
Egypt	10,929	+ 2,326	*	—	*	—	1,400	– 1,750
China	12,902	+ 3,138	*	—	*	—	2,619	+ 20
Brazil	25,994	+ 20,704	*	—	*	—	*	—
Argentina	36,770	– 3,134	*	—	1,363	– 912	1,833	– 375
Soviet Union	*	—	*	—	—	– 1,897	*	—
Other Foreign Countries	78,375	+ 2,511	8,198	– 975	23,701	– 1,745	64,379	+ 34,216
Total	£827,737	+ £97,430	£56,069	+ £11,214	£105,774	+ £19,887	£293,584	+ £123,062

* Not classified separately.

Progress in Transmission and Distribution

A five-year survey

A SURVEY or developments in electrical transmission and distribution during the past five years has been contributed by Messrs. C. F. Bolton and R. H. Abell to the *Journal* of the Institution of Electrical Engineers. Attention is first directed to the increasingly large number of systems abroad that are operated at about 220 kV and then to notable developments within the Empire. Reference is made to the possibilities of high-voltage d.c. transmission as effected by the Marx gas-cooled arc convertor and the application of grid control to mercury-arc and hot-cathode rectifiers.

For overhead lines wood poles with galvanised-iron fittings continue in favour, but with building developments the tendency increases to use steel towers, especially at 33 kV and above, owing to the longer spans permissible. There need be no trouble from cracks and corrosion of the reinforcement of concrete poles, but their large diameters make maintenance difficult and special ladders are required to reach the cross-arms, while alterations in height or position are not easily accomplished.

An even coating of zinc (not less than 2 oz. per sq. ft.) by the hot galvanising process usually makes the painting of steel towers unnecessary for many years. Corrosion of steelwork below ground is rare if water is prevented from lodging at or just below ground level. Surfaces of towers of copper-bearing steel, which have been painted instead of galvanised, appear to be in good condition after five years' exposure.

Departures from standard construction for l.v. lines on steel towers include an arrangement permitting the reduction of torsional stress due to broken conductors by rotational movement of the cross-arm. The use of steel-reinforced aluminium conductors has increased, especially for 33 kV and upwards; corrosion of the steel core has caused no trouble, but breakage of individual aluminium strands has occurred at line clamps just inside the mouth. Bolted clamps have largely been superseded by tension clamps with coned surfaces. Vibration is associated with line tension, usually with steady winds of from 2 to 10 m.p.h. and at lower temperatures. The frequency of the vibrations generally lies between eight and sixty cycles per sec., and the amplitude may reach 1¼ in. with loop lengths of from 4 to 40 ft. Notes are given on the Bates, Stockbridge, Hoffmann, Varney and other vibration dampers, and also forms of conductor designed to give similar effects.

Copper conductors have been almost entirely free from vibration failures owing probably to the lower tensions used. A new "strand dynamometer" for checking tension is briefly described.

Insulator Design

Three factors mainly influence the design of insulators: (1) minimum of surface on which matter can settle; (2) maximum of surface washed by wind and rain; (3) adequate dry and wet flashover values. The first two conditions are met by plain cylindrical porcelain used vertically, but not the third, as the length required involves mechanical weakness. A reference is made to the details of insulators that effect a satisfactory compromise and to the investigations carried out by the Central Electricity Board.

The periodic washing of insulators of live conductors is being carried out where flashovers have occurred due to salt deposits on cap and pin insulators. Mention is made of the use in Australia and America of CO_2, which, when mixed with water, forms a weak acid that dissolves greasy deposits.

Grading rings on long insulator strings protect both the insulator units and line conductor in the event of a flashover, as well as improving the voltage distribution over the string. On 33-kV lines it is now standard practice to fit horns at the conductor end of the string to avoid burning. One device for testing insulators on live lines consists of a neon lamp and transformer mounted on a pole; by making and breaking contact across each insulator in turn, the potential distribution curve can be determined.

Electrical interference with communication lines can now be approximately pre-calculated. Disturbance from a.c. systems is usually due to earth currents, particularly multiples of the third harmonic, but multiple earthing does not necessarily give large neutral currents. There appears to be no recorded case in this country, where solid earthing is extensively used, of acoustic shock arising out of unbalance of a system during fault conditions.

Most cases of damage to overhead systems were due to direct lightning strokes, which begin at the line and advance upwards towards the cloud. If the induced or applied voltage is less than the impulse flashover, a wave of half its value is propagated along the line in both directions and is reflected from the ends of the line or sub-station apparatus. On striking a transformer winding it will be doubled by reflection. With a short steep wave the stress will be concentrated on the end turns, longer waves tending to produce internal oscillations that may reach a greater magnitude than the initiating wave.

Protection of sub-stations against direct strokes has been obtained by extending the transmission line earth wire over the building. Surge absorbers on lower voltage systems have been designed to slope the front of the incoming wave and thus to reduce the amplitude of the surge. By earthing secondary neutrals of distribution transformers by lightning arrestors, a reduction of fifty per cent. in interruptions of supplies has been reported.

The co-ordination of line insulator, bushing and transformer insulation by an air-gap that establishes the insulation level required for any circuit voltage is a recent development. Such gaps have a time-lag and do not afford protection against direct strokes or steep-frontal waves at settings adequate for normal conditions. The principal methods in use for reducing failures due to lighting are: earth wires (two for double circuit lines), low tower-footing resistances, application of counterpoise to towers, expulsion gaps on insulator strings, and arc-suppression coils for neutral earthing.

Cables and Switchgear

Cable development has been marked by the increased use of oil-filled h.v. cables and by the introduction of gas-pressure cables. For voltages above 33 kV three single-core cables are general, but three-core oil-filled cables are being made for 33 and 66 kV and are being considered for 132 kV. It has been established that the preliminary stage of breakdown in the higher-voltage cables begins as a discharge through and along paper layers, starting from the conductor. The thickness of paper used on 11-kV cables working earthed has been decreased considerably, the order of the reduction being from 0.21 to 0.15 in., and the maximum working temperature has been raised. The 66-kV three-core cable employing externally applied gas pressure (12 atm.) to prevent ionisation in voids, which was laid for the C.E.B. between Hackney and Walthamstow (2¼ miles) has been in successful operation since 1932.

Routine testing of cables by a d.c. voltage of twice the a.c. working voltage is now adopted by many undertakings. The continuous extrusion of lead cable sheaths, which eliminates minor defects and provides a uniform thickness, is among the manufacturing developments mentioned.

In the switchgear section reference is made to the work of the three circuit-breaker testing stations in this country and the ability to calculate the rate of rise of re-striking voltage (reaching 6 kV per micro-sec.) with the aid of the cathode-ray oscillograph. The principal aim in design is to take advantage of the zero pause in the current wave and to reduce the arc length. Various forms of arc-control devices are reviewed. Metal-clad switchgear has been built for 66 and 132 kV, occupying about twenty per cent. of the space required by open-type equipments in low type sub-stations and forty-five per cent. in high type sub-stations. Circuit-breakers up to 250,000 kVA are usually provided with local hand operation, above that and up to 350,000 kVA remote mechanical operation, while for larger breakers remote electrical operation is standard. The recent use of compressed air, cartridges, special a.c. and d.c. generators, and springs is described. During the past five years the rupturing capacity of high-voltage fuses has increased over six times to one million kVA at 132 kV.

Transformer Practice

Transformers have increased in maximum capacity during the same period from 75,000 kVA to 93,750 kVA, three-phase, and the minimum size for 132-kV working (stepping down to 110 V) is 16 kVA, single-phase. The smallest three-phase 132-kV transformer is 3,000 kVA. Self-cooled units up to 30,000 kVA have been installed. Lower flux densities have recently been re-adopted to avoid excessive harmonics in voltage wave form. A recent tendency in tap-changing has been the accommodation of the gear in a separate tank.

Non-resonating transformers, in which the voltage is evenly distributed throughout the winding under high voltage transients, have come into use as potential transformers up to 132 kV. Two 30,000-kVA 132-kV power units have also been built. Oil-immersed wound reactors are being used for 22 kV and above, for which the concrete cast-in type is unsuitable. Earthing of the neutrals of 11-kV and 33 kV systems has been done through Petersen coils; these are claimed to reduce the number of outages on overhead lines by 80 per cent., but on extensive networks they make discriminative protection difficult with double earth faults.

Other sections of the review (which occupies twenty-two pages of the *Journal*) discuss protective systems, voltage regulation, centralised control and fire-fighting equipment.

Key Industry Duties

THE report of the Board of Trade Committee appointed to consider the position that will arise on the expiry upon August 19th of the duties imposed by the Safeguarding of Industries Act, 1921, as amended by the Finance Act, 1926, has issued its report (Stationery Office, 3d. net).

The reasons for imposing the duties are stated by the Committee which gives a brief history of the working of the Act. The Finance Act of 1926 continued the duties for a further ten years, increased the duty on optical glass, elements and instruments from 33⅓ per cent. to 50 per cent. *ad valorem* and altered the basis of duty on arc-lamp carbons from an *ad valorem* assessment to a specific duty of 1s. per lb. Amorphous carbons (excluding primary-battery and arc-lamp carbons) were added to the list of articles subject to a 33⅓ per cent. duty.

The 1934 Finance Act raised the duties on arc-lamp carbons to 5s. per lb. for carbons exceeding 14 mm. in diameter and 7s. 6d. per lb. for other carbons.

The articles covered by the schedule to the 1921 Act, as amended by the 1926 Finance Act included :—Optical glass and certain scientific glassware; galvanometers, pyrometers, electroscopes, barometers, analytical and other precision balances, and "other scientific instruments, gauges and measuring instruments of precision of the types used in engineering machine shops and viewing rooms whether for use in such shops or rooms or not"; wireless valves and similar rectifiers and vacuum tubes; ignition magnetos and permanent magnets; arc-lamp carbons; metallic tungsten, ferro-tungsten and manufactured products of metallic tungsten and compounds (not including ores or minerals) of thorium, cerium and the other rare earth metals; amorphous carbon electrodes (not including primary-battery carbons); and molybdenum and vanadium compounds.

After hearing much evidence the Committee is satisfied that, "with some minor exceptions," research is being continuously undertaken by the industries concerned and large sums of money are being expended annually for this purpose. The Committee has, however, noted a lack of co-ordination in research among the producing units of some industries and this should be remedied. It is considered that the protection afforded by the Key Industry Duties encouraged research and fostered development.

In spite of intensive competition from abroad and a recent tendency for certain imports to increase the output of a number of the Key Industries has been multiplied several fold since 1921. The duties have made possible internal trade agreements and there have been many cases of large price reductions which have led to increased consumption. In a number of instances a considerable export trade has been built up in the face of strenuous international competition. The evidence seems to the Committee to prove that, given equal opportunities, British manufacturers are at least the equal of their competitors.

The Service Departments were unanimous in desiring the duties to be continued and in their evidence the majority of the manufacturers concerned pointed to the necessity for an assurance of protection for a settled period.

It is accordingly recommended that the duties should be continued in their present form for a further period of ten years at rates not less than the existing ones, but subject to certain modifications in procedure. It is proposed that the Import Duties Advisory Committee shall be empowered to deal with applications for increases or modifications of the duties as in the case of applications under the Import Duties Act, instead of including alterations in the next Finance Act.

The Committee recommends that licences permitting the import of articles free of Key Industries Duty shall be issued by the Treasury on the recommendation of the Board of Trade and it is suggested that such articles should be exempted also from all duty under the Import Duties Act.

Representations were made to the Committee to recommend the addition of a number of products to the schedule and definite recommendations on this matter are made. It is proposed that "granular activated carbon of non-animal origin" shall be subject to an *ad valorem* duty of 33⅓ per cent. The Committee is also of opinion that the circumvention of the duties on arc-lamp carbons by the importation of carbons in an unfinished condition should be prevented by imposing the duty applicable to carbons of 14 mm. diameter or less upon parts of arc-lamp carbons of all sizes imported in a state in which they can be recognised as such by the Customs. The duty should apply whether such parts are in a finished condition or are themselves imported in an unfinished state.

The Committee understands that the progress of the British radio valve industry is being retarded by importations from foreign countries of parts which are merely assembled here. It is therefore considered that such parts and parts of rectifiers and vacuum tubes should be subject to the same duty as the complete articles—33⅓ per cent. *ad valorem*.

To prevent forestalling the Committee recommends that the new additions should be made with as little delay as possible.

In the course of his Budget speech on Tuesday last the Chancellor of the Exchequer (Mr. Neville Chamberlain) stated that the Committee's recommendations were to be adopted by the Government. They would be embodied in the Finance Bill and the necessary resolutions were being tabled.

The Met-Vick. Summer School

THIS week a summer school has been held at the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd. Several lectures and visits were carried on simultaneously, offering a bewildering choice of subjects. Thus so much of the mechanical engineering side (Course A) has been of electrical interest that a difficult problem was set at the outset on Monday as to whether one should attend the lecture on mechanical, metallurgical and chemical research (Messrs. R. W. Bailey, L. E. Benson, A. A. Pollitt, and A. M. Roberts) or the symposia on insulating materials (Messrs. B. L. Goodlet, A. R. Dunton, J. M. Fleming, and A. Monkhouse) and high-vacuum engineering (Messrs. J. W. Buckley, C. Sykes, G. S. Innes and J. M. Dodds) which were provided in Course B.

On Tuesday morning the same hard necessity of choice was presented by the papers on turbines and condensers (Mr. H. L. Guy) in the first group and on motor design (Mr. D. B. Hoseason) or, alternatively, switchgear developments (Mr. H. Pearce) in the second, with the option of regarding oneself as a science master in order to hear the lectures on traction signalling (Messrs. T. Ferguson and G. L. Newman) and on research department intelligence service (Miss B. M. Dent) which were prescribed for Course C. In the afternoon came a lecture on trends on mechanical research and symposia on acoustics (Messrs. B. G. Churcher, C. Dannatt and A. S. King) and on h.v. practice (Messrs. T. E. Allibone, F. S. Edmonds, G. S. Innes, D. B. McKenzie, A. K. Nuttall and R. V. Whelpton).

The primarily "mechanical" people went to the continuation of the lecture on turbines and condensers on Wednesday morning, while the "electricals" heard lectures on either circuit-breaker testing (Mr. W. A. Coates) or on mining equipment (Messrs. J. F. Perry and B. C. Metcalfe), and the science masters heard something of the latest practice in electric motors (Mr. H. West) and large electrical machines (Mr. L. H. Carr) and in works organisation (Mr. J. M. Newton).

The first subject yesterday was a lecture on welding common to all three courses, which split up again in the afternoon for lectures on the mechanical design of large electrical machines (Mr. R. Townend) and of large rupturing capacity switchgear (Mr. D. R. D. Davis) in the first group, the design of electric traction control equipment (Mr. R. Brooks), and of modern transformers (Mr. A. G. Ellis) in the second, and on transformers (Mr. F. E. Hill) and switchgear (Mr. F. E. Capper) in the third. A shorter Course D was opened for education officers with an introductory talk by Lt.-Col. K. G. Maxwell.

All the above lectures were sandwiched between visits to appropriate sections of the Trafford Park Works, which formed an essential part of the whole scheme.

While sectionalisation of the technical programme during the day was necessitated by the great range of subjects dealt with, there was plenty of opportunity for more informal discussions during the lunches at the works canteen and during the evenings at the hotels. The main co-ordinating links between the courses, however, were the addresses given in common assembly during the evenings at the M.V. Club, where Mr. A. P. M. Fleming spoke on the work of the Met-Vick education and research departments on Monday and where Mr. G. McL. Yuill presided at an "Apprentice Association" on Tuesday. These were followed on Thursday evening by a discussion, opened by Professor J. Hollingworth on the training of the engineer.

To-night the members of the summer school are to be guests of the company at a dinner at the Grand Hotel, Manchester. Other events to-day include a review of the company's electrical work (Mr A. W. Muir), lectures on machine tool practice (Mr. T. Smith), recent developments in large machine design (Mr. R. Townend), traction motors (Mr. G. H. Fletcher), feeder protection (Mr. M. Kaufmann), industrial control (Mr. S. C. Lloyd), turbines and condensers (Mr. L. S. Robson), and organisation of works' supplies (Mr. H. W. Brighten).

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The Budget

On Tuesday last Mr. Neville Chamberlain, the Chancellor of the Exchequer, disclosed his plans for the financial year 1936-37. He showed that there was a surplus from the past year of £15½ million (including the amount available as a fixed debt charge for debt redemption). He estimated that on the existing basis he would have to face a deficit of £21,291,000. To meet this he proposed to raise the standard rate of income tax by 3d. (making it 4s. 9d. in the £). At the same time he was increasing the amount of "family" reliefs, and intended to take steps to stop certain evasions of the tax. The tea duty was to be raised by 2d. per lb., and the Road Fund balance of £5,250,000 would be "abstracted." After mentioning a number of minor adjustments which were to be made, the Chancellor said that the recommendations of the Committee on Key Industry Duties (see page 609) were being accepted by the Government. It was also proposed to form a company—the Special Areas Reconstruction Association, Ltd.—to finance small businesses, existing or to be formed, in the "special areas."

New Municipal Showrooms

New branch showrooms and offices of the Colchester Corporation Electricity Department were formally inaugurated on April 16th at Walton-on-the-Naze by Mr. W. Lowther Kemp, chairman of the Frinton and Walton-on-the-Naze R.D.C. Mr. C. G. Morley New, M.I.E.E., Electricity Commissioner, said that it required courage and spirit to embark on the extension of services to an outside area and that had been successfully done by Colchester which had a supply area of 270 sq. miles. Ald. A. O. Ward, in referring to the progress of the Electricity Department said that the Electricity Committee was to submit new tariffs to the Council which, if adopted, would take effect as from April 1st. The 15 per cent. transmission costs would be reduced to 10 per cent. in the extended area; the rate for lighting from 7½d. to 7d.; domestic rate (assessments on smaller dwellings, 500 cubic ft.), from 11s. 3d. per quarter to 10s.; and the "unit" charge to all domestic consumers of 500 kWh and over per quarter, from ¾d. to ½d. There were also many smaller concessions amounting in all to over £5,000.

Senior demonstrators and saleswomen at the Lighting Service Bureau

The Shipping, Engineering and Machinery Exhibition

The next Shipping, Engineering and Machinery Exhibition will be held at Olympia, London, S.W., from September 9th to September 25th, 1937. The exhibition will in future be known as "The Engineering and Marine Exhibition," the original name being retained in a sub-title.

Price Increase

The Metropolitan-Vickers Electrical Co., Ltd., informs us that certain prices given in its pocket price list (special publication 7020/0-2, January, 1936), covering a.c. and d.c. electric motors and control gear, have been slightly increased. From May 1st next, prices of type D and DY d.c. motors and slide rails on pages 12 and 13, become subject to an increase of 5 per cent.

Employment in March

Employment in the engineering industry during March showed a further general improvement and was fair on the whole, being good in electrical engineering. The *Ministry of Labour Gazette* states that the number of unemployed in the engineering industry decreased by 8,935 to 89,196, and the percentage from 10 to 9 (12.6 per cent. in March, 1935). In the electrical engineering section the number of unemployed was 4,959 or 5.3 per cent., as against 5.7 per cent. in February and 7.6 per cent. in March, 1935. The unemployed in the electrical wiring and contracting industry numbered 4,812, the proportion falling from 14.9 to 13.6 per cent. (15.7 per cent. in March, 1935). In the electric cable, apparatus, lamps, &c., group, the number of unemployed was 13,306, the proportion decreasing from 10.3 to 9.4 per cent. (11.1 per cent. in March, 1935).

A Long Service Cable

Messrs. W. T. Henley's Telegraph Works Co., Ltd., have drawn our attention to a cable which has seen considerable service. The cable was taken out of an installation at the City of London Boys' School after being in service for twenty-one years. It was installed underground in conduit, and on examination the braid and compound were found to be in excellent condition.

Trend in Design

We have received a copy of the first number of "Trend in Design," a quarterly magazine published by Trend, Ltd., 58, Bloomsbury, W.C. The object of this periodical is to record changes in the appearance of everyday things, and the current issue discusses such subjects as household refrigeration, pottery design and the packaging of manufactured goods.

Works and Office Lighting Conference

A two-day conference for works and office engineers and executives will be held at the Lighting Service Bureau on May 19th and 20th. The first session will be opened by Sir John Brooke, vice-chairman of the Electricity Commission, and the discussion will be opened by Air Vice-Marshal Sir David Munro. The talks to be given during the two days are as follows:—"The Science of Seeing," by Mr. W. J. Jones; "The Scientific Control of Light Flux," by Mr. A. D. S. Atkinson; "Lighting Units and Fundamentals," by Mr. H. Lingard; "Modern Industrial Lighting with special reference to Electric-discharge Lamps," by Mr. J. W. Howell; "Electric Lamp Characteristics," by Dr. A. B. Whitworth; "Planning Lighting Installations," by Mr. W. Hime; "Lighting of Commercial Buildings," by Mr. E. B. Sawyer; and "Special Lighting Problems," by Mr. R. O. Ackerley.

In the accompanying illustration we show some of the women who attended the Bureau on April 7th during the 1936 Course for Senior Demonstrators and Saleswomen in the Electrical Industry.

Exide Convention at Harrogate

The sixteenth annual Exide Convention will be held at Harrogate from June 17th-19th. The Convention headquarters will be at the Hotel Majestic and the chairman will be Mr. D. P. Dunne, managing director of the company, who will welcome a number of delegates from overseas. The mornings will be devoted to business discussions and a number of functions of a social and recreative nature will be held in the afternoons.

Recent Orders

The Alpha Manufacturing and Electrical Co., Ltd., has secured the contract for the electric lighting, power and bell installation at the new Signal Experimental Establishment, Woolwich, S.E.

Messrs. F. W. Brackett & Co., Ltd., have secured a contract for three of their patent "central flow" band-type circulating water screens for the Table Bay power station, Capetown. They have also received an order for two more of their patent circulating water screens for the State Electricity Commission of Victoria for the Yallourn power station.

Social Events

The annual dinner-dance of the Sloan Electrical Co.'s Social Club was held last Saturday at the First Avenue Restaurant, London, W.C.1. Mr. L. G. Sloan, who is president of the Club, said that the company's policy was to protect prices and give quality and good service to the customer—good service was especially important. "Our President" was proposed by Mr. W. J. Bensley, and received with musical honours. Mr. Sloan was then presented with a cut-glass bowl as an expression of good wishes from the staff. Mr. H. D. Denman, general manager, proposed the toast of "The Com-

pany" in his usual lively way, and Mr. M. V. Ely, managing director, responded. Mr. J. McLennan proposed the health of the guests and Mr. Stanford replied. After the dinner there was dancing for which music was provided by the Ken Wood Salon Orchestra.

An "Xcel" Sales Conference

The first sales conference of Elexcel, Ltd., was held at the company's head office and factory, Liverpool, on April 14th, 15th and 16th. Every phase of the company's activities was discussed, particularly sales policy and development under the new regime. The board of directors was present on the third day when the conference deliberations and decisions were summarised. Our picture shows a group at the conference.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry announces that a fall in the cost of living to 44 per cent. above the 1914 level will involve a decrease in wages in the industry on the third pay-day in May. The new scale of weekly wages is as follows: Male time workers: District No. 1, ranging from 50s. 11d. in class 1 to 56s. 9½d. in class 4; district No. 2, ranging from 45s. 6d. in class 1 to 51s. 6d. in class 4. Youths and boys (14-20): District number 1, from 13s. 2½d. to 41s. 7½d.; district number 2, from 12s. 6d. to 38s. Women (eighteen or over): From 25s. 6d. to 29s. 6d. in class 3. Girls (fourteen-seventeen): From 12s. 6d. to 17s.

Trade Announcements

Mr. Frank F. Bradshaw has commenced business as an electrical engineer at "Kippure," Hardens Road, Duns, Berwickshire.

M.S.L., Ltd., has removed to Splendor Amp Works, Morden Factory Estate, Morden Road, S.W.19 (telephone: Liberty 2453).

Frank Sandell & Sons, Ltd., have opened new showrooms at 4 and 5, Liverpool Buildings, Worthing, for electrical fittings and wireless equipment.

Messrs. Edward Till & Co., Ltd., have removed their registered office and saleroom to 36, Mincing Lane, E.C.3. The telephone number remains unchanged.

The Midland Electric Installation Co., Ltd., is removing shortly to Cyprus Works, Upper Villiers Street, Wolverhampton. Provision is being made at the new works for a considerably increased output. The company will specialise not only in electrical repairs, but is also putting in the necessary plant to carry out mechanical repairs to electrical machinery.

French Electrical Imports and Exports

French imports and exports of electrical machinery, apparatus and cognate material during 1935 as compared with 1934 are shown in the appended tables. The values are given in thousands of francs, while, for purposes of comparison, the sterling value of the totals, converted at the rate of 75 to the £. is added:—

	Imports.		Exports.	
	1934. 1,000 fr.	1935. 1,000 fr.	1934. 1,000 fr.	1935. 1,000 fr.
Dynamo-elec. machines, transformers and parts	44,913	31,599	40,281	28,400
Telegraph, telephone and other electrical appliances	184,734	131,157	81,883	90,458
Incandescent lamps and radio valves	57,145	41,329	18,434	14,022
Arc lamps and parts ...	130	94	135	70
Carbons for electrical and industrial purposes ...	6,577	5,342	12,887	12,667
Electric wires and cables	20,294	4,773	21,354	24,847
Parts of electrical apparatus	18,987	17,305	15,291	10,278
Magnets, other than electro-magnets ...	1,060	576	—	—
Accumulators and parts ..	2,593	1,382	11,994	11,225
Dry batteries and condensers	14,394	19,943	2,871	2,508
Porcelain and other insulators	3,301	2,238	8,328	7,213
Total fr.	354,128,000	255,738,000	213,458,000	201,688,000
Total at 75 fr. to £ ...	£4,721,706	£3,409,840	£2,846,106	£2,689,173

It will be seen that the imports declined by £1,311,866 or over 27 per cent. Of the eleven items scheduled only one shows an increase, dry batteries and condensers, while the largest decrease occurred in telegraph, telephone and other electrical apparatus. On the export side, the decrease was not so great, amounting to only £156,933, or about 5.5 per cent.

Britain's Colonial Export Market

At a meeting of the Institute of Export held at 21, Tothill Street, S.W.1, on April 28th, Major Sydney Pascall in the chair, Major W. E. Simnett, M.B.E., delivered an address on "The Colonial Empire—Britain's Greatest Export Market." Describing the special features of the Colonial market and the means by which its requirements could be studied, Major Simnett said that the total trade of the Colonial Empire (imports and exports) in the year 1934 amounted to £360,000,000. The complete 1935 figures were not yet available, but trade on the whole had been steadily improving since 1934, and prices also had shown in many instances an upward tendency, so that the total was greater now. This compared with a total trade of £500,000,000 before the depression started, but the difference was accounted for by the fall in prices rather than by any lessening in total volume; indeed, it was quite possible that the volume was on the whole greater now than in 1929, but much lower prices, especially as regarded Colonial products, were obtained for the goods. The Colonial Empire already took over 11 per cent. of our total exports; that is, it was our largest single market. India was next with about 9 per cent.; the United States, the leading foreign country, had less than 5½ per cent. According to the *Statistical Abstract of the British Empire*, in 1934, of the total exports of the Colonies 26 per cent. came to the United Kingdom—of their total imports about 22 per cent. were from Great Britain. Our task was to increase not only our share in Colonial markets but also very considerably the total volume of Colonial trade. Our effort should be to capture the quality market and leave the cheap lines to others. Systematic, continuous and intelligent advertisement was essential, coupled with knowledge of local requirements obtained both directly and through reliable agents, and readiness to adapt practice to local market needs and conditions.

Delegates to the "Xcel" sales conference

Front row (left to right).—Messrs. R. G. Ostler (Scotland), A. C. Goodall (Commercial Department, Sales), P. M. Edinborough (manager), F. C. Burstall (director), J. Parry (works superintendent), H. G. W. Haslett (London). *Back row (left to right).*—Messrs. C. H. Judd (Commercial Department, Technical), L. Houldridge (East Anglia), I. S. Plumtree (London and the South), E. E. Allison (Manchester), T. L. Purves (Bristol), E. G. Sellers (Leeds), R. C. Roberts (Birmingham), R. A. Keir (Publicity).

Twenty-five Years of Wireless

This month *The Wireless World*, which is by many years the oldest wireless journal in the world, celebrates twenty-five years of publication. The pages of the journal in the past provide a continuous record of the development of wireless telegraphy, wireless telephony, broadcasting and television, since April, 1911. The issue of May 1st is to be in the nature of a Souvenir Number and a "cavalcade of wireless" through twenty-five years will be the feature of the issue.

"Maxtorq" Motors

In the course of the article on the Port Sunlight works in our April 10th issue (p. 521) we referred to a "Maxtorque" motor supplied by the English Electric Co., Ltd. This did not bear the trade name "Maxtorq" which is employed by Lancashire Dynamo & Crypto, Ltd. The motors mentioned later in the article as being supplied by the Lancashire Dynamo Co. *were* "Maxtorq" machines.

The "Sweden Year Book"

The 1936 edition of the "Sweden Year Book" has recently been published by the Ministry of Foreign Affairs in Stockholm. This contains a fund of information regarding all Swedish affairs, and includes chapters on the water power resources of the country, its industrial and economic life, foreign trade, and export industries.

"Tangent" Electrical Products

Messrs. Gent & Co., Ltd., Faraday Works, Leicester, have issued a broadsheet containing a list of illustrated catalogues of "Tangent" electrical products.

The Amended South-East England Scheme

The Central Electricity Board has adopted the South-East England Electricity (Alteration and Extension) Scheme, 1936, which was published on Tuesday. Copies may be obtained from the Stationery Office (6d.). Particulars were given in the ELECTRICAL REVIEW of March 6th (page 367).

Next Year's B.I.F.

The Department of Overseas Trade announces that the British Industries Fair will take place next year from February 15th to February 26th in London and Birmingham. In addition to Olympia, the Department has leased the new exhibition buildings now under construction at Earl's Court, where the accommodation is better suited to the needs of the Fair than that occupied at the White City for the last ten years. The textiles, furniture fabrics and furniture sections which have been housed at the White City will therefore all be transferred to Earl's Court. The Empire Section, consisting of official displays by Governments of the Dominions and Colonies, will also be moved from Olympia to Earl's Court. The other sections of the Fair will remain in approximately their present positions in Olympia and at Castle Bromwich, Birmingham.

British Industry in 1935

At the annual meeting of the Federation of British Industries held on April 22nd, Sir Francis Joseph, the retiring president, said that his year of office had coincided with a period of difficulty, but also one of substantial achievement for British industry. Our increasing share of world trade proved that we had used the lean years to reorganise our plant and attain a standard of efficiency which equalled if not excelled that of any other country. The spirit of adventure still inspired British industrialists. The recovery in our home and overseas trade since 1932 was a striking proof that the resource and courage of those responsible for our industries was still a vital factor in world trade revival. The number of people employed in British industry had now reached a new and enviable record. The world outlook, especially as regarded the continent of Europe, was not good, but facing realities as industrialists, they realised that the problems of the world, and especially of Europe, were economic rather than political. Until currencies were stable and functioned properly, the policy of intensive nationalism which prevented prosperity from reaching fruition would continue.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price. April 22nd.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ... ,,	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£191	£6 dec.
Grade II... ... ... ,,	£132	£4 dec.
Grade III ... ... ,,	£69	£2 dec.
c Brass (rolled metal 2" to 12" basis) ... per lb.	7⅞d.	—
c ,, Tubes (solid drawn) ... ... ,,	9⅝d. to 10d.	—
c ,, Wire, basis ... ... ,,	7⅞d.	—
c Copper Tubes (solid-drawn) ... ,,	10½d.	—
g ,, Bars (best selected) ... per ton	£68	—
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£41 15s.	15s. inc.
d ,, ,, Wire Rods ... ,,	£47 15s.	15s. inc.
d ,, ,, H.C. Wire ... per lb.	7⅝d.	☆ inc.
f Ebonite Rod ... ... ,,	1/6 to 2/– plus 1/3 to 1/6 10%	—
f ,, Sheet ... ... ,,		—
n German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	9d.	—
i Iron, Pig (Cleveland No. 3) ... per ton	67/6	—
i ,, Wire galv. No. 1, P.O. Qual.... ,,	£20	—
g Lead, English Pig	£17 15s.	10s. dec.
g Mercury ... ... per bot.	£12 to £12/10/–	—
e Mica (in original cases) small ... per lb.	9d. to 1/6	3d. to 6d. inc.
e ,, ,, medium ... ,,	5/– to 10/–	—
e ,, ,, large ... ,,	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11¼d.	—
p ,, ,, rolled strip & sheet ,,	11½d.	—
p ,, ,, wire ... ... ,,	1/0¼	—
o Platinum ... ... per oz.	£7	—
d Silicium Bronze Wire ... ... per lb.	8 7/16d.	☆ dec.
g Spelter ... ... per ton	£15 7s. 6d.	15s. dec.
r Steel, Magnet, in bars ... ... per lb.	7½d.	—
Tin, Block (English) ... ... per ton	£207 5s.	£7 10s. dec.
,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

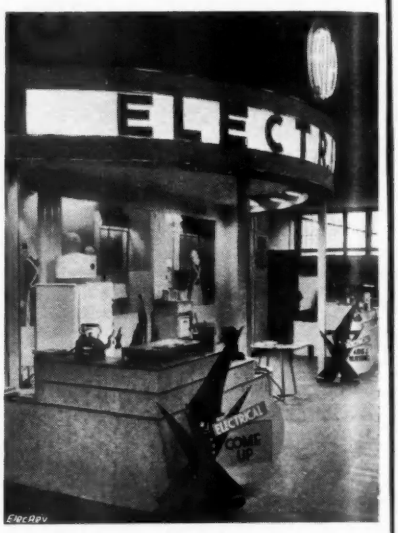
Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

Electricity for Health

Some of the ways in which electricity can be used to promote health both in the home and in hospitals are demonstrated by the British Electrical Development Association at the annual Hospitals, Nursing, Midwifery and Public Health Exhibition and Conference at the University of London which concludes to-day (Friday). A model solarium in which a group of happy children is seen enjoying artificial sun-ray treatment, occupies a portion of the main exhibit; among the apparatus used here is the new Hanovia "Junior Alpine Sun" portable ultra-violet ray lamp, which has been specially designed for use by doctors in the course of their visits. A nurse drawing water from a "Bellberry" heater forms the central figure of a kitchen display, which includes an electric towel-rail and a "Thermega" electric blanket. The totally - enclosed spherical lighting fittings seen here are, of course, ideal for hospital use. At each side and in front of this kitchen exhibit is a selection of other domestic appliances, including a B.T.H. refrigerator, a Jackson cooker, and a Hotpoint vacuum cleaner. "The Ward," as the third of these displays is called, shows a sleeping child and a night nurse doing her rounds; in the wall close to the bed is an inset fire. Along the front of the stand runs a counter on which are displayed electrical appliances which are of particular use in the sick-room, such as sterilisers, hot-water bottles, bronchitis kettles, foot mats, milk boilers, and immersion heaters, together with items of more general application, such as tubular heaters, fires and fans. The stand, which is one of the most attractive yet arranged by E.D.A., is plentifully besprinkled with the now well-known "I'm Electric" symbol, and round the semi-circular façade is the word "Electricity" in cut-out blue letters on an orange background. A blue neon sign surmounts the display. On a separate stand the Chloride Electrical Storage Co., Ltd., has a working example of its "Keepalite" emergency lighting equipment, which is now installed in over 270 hospitals and nursing homes.



The E.D.A. stand at the Public Health Exhibition

Porcelain in Poland

A correspondent of the *Gazeta Handlowa* draws attention to the increasing quantity of porcelain for electrical purposes being imported into Poland, and suggests that in the interests of the home industry a veto should be imposed on the imports and quotas of the countries concerned. If this is not done he believes that the three Polish works producing electrical porcelain may have to shut down and discharge their workers.

New Catalogues and Lists

Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham, 5.—An attractive booklet giving particulars of "Memota" and "Auto-Memota" starting gear for a.c. motors up to 15 h.p.

Sloan Electrical Co., Ltd., 54, Fetter Lane, London, E.C.4.—Leaflets dealing with commercial lighting fittings which have recently been introduced.

British National Electrics, Ltd., Newarthill, Motherwell, Lanarkshire.—Pamphlets describing "Utility" convectors and "Universal" washing machines.

Electroflo Meters Co., Ltd., Abbey Road, Park Royal, London, N.W.10.—A 53-page art booklet, profusely illustrated, dealing with electrical flow metering.

Ferranti, Ltd., Hollinwood, Lancs.—List IR3, dealing with a maximum demand relay.

J. G. Statter & Co., Ltd., 82, Victoria Street, London, S.W.1.—Ironclad vertical draw-out switch pillars are described in publication No. 221.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, London, S.W.1.—A stock list for April.

Enfield Cable Works, Ltd., 295, High Holborn, London, W.C.1.—Eight-page coloured folders dealing with radio conductors, radio relay cables and arc-welding cables.

Bratt Colbran, Ltd., 10, Mortimer Street, London, W.1.—A catalogue of electric radiators and fireplaces.

Rhodes, Brydon & Youatt, Ltd., Waterloo Engineering Works, Gorsey Mount Street, Stockport.—Details of the "Mopump" small vertical units of the sump drainage type.

Watson & Sons (Electro-Medical), Ltd., 43, Parker Street, London, W.C.2.—Details of a new mobile ward outfit.

L. G. Hawkins & Co., Ltd., 30/35, Drury Lane, London, W.C.2.—An illustrated booklet dealing with the new "Supreme" washer.

Bankruptcy Proceedings

W. E. Lambert, Market Street, Wymondham, Norfolk, radio dealer, &c.—The first meeting of creditors was held on April 14th at the Official Receiver's office, 3, Cathedral Street, Norwich. The statement of affairs showed gross liabilities of £348, of which £336 was expected to rank for dividend, with assets estimated to realise £6, leaving a deficiency of £330. No books of account had been kept and the debtor attributed his failure to bad trade and competition. The case being a summary one was left in the hands of the Official Receiver as trustee of the estate.

E. A. Freeman, 260, High Street, Ponders End, Middlesex, wireless dealer.—A receiving order was made on the debtor's own petition, and he has filed a statement of affairs showing gross liabilities of £510, of which £382 is expected to rank for dividend, with net assets of £6, leaving a deficiency of £376. The debtor attributes his failure to default by customers under hire purchase agreements and ill-health.

N. H. P. Jones, 15, North Street, Dowlais, Merthyr Tydfil, dealer in electrical and wireless goods.—The public examination in this matter took place at the Town Hall, Merthyr Tydfil, on April 15th. Debtor attributed his present position to industrial depression and trade competition. His statement of affairs showed a deficiency of £611. The examination was closed.

S. Hancock (S. Hancock & Co.), electrical engineer, Clyde Street, Holt Town, Manchester.—First and final dividend of 1¼d. in the £, payable April 24th at the Official Receiver's office, Byrom Street, Manchester.

A. Ambrose, electrical engineer, 137, Market Street, Chorley.—First meeting April 27th at 9, Fox Street, Preston. Public examination May 15th at the Sessions Hall, Preston.

J. E. Lander, electrical and radio engineer, 26, Union Street, and 12, School Road, Newton Abbot.—Trustee, Mr. H. H. Fielding, 9, Market Street, Newton Abbot, released March 6th.

B. Sheechman (Pentonville Radio), 269, Pentonville Road, N.—Last day for receiving proofs for dividend May 2nd. Trustee, Mr. C. Bruce Park, Bankruptcy Buildings, Carey Street, W.C.

A. Harrison, electrical engineer and contractor, 110, Town Street, Horsforth, near Leeds.—First and final dividend of 10d. in the £, payable April 29th at 24, Bond Street, Leeds.

Company Liquidation

Artisco Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. E. Viney, 68, Coleman Street, E.C.

Private Arrangements

E. J. Hilton, wireless dealer, 37, Broad Street, Kings Lynn.—At the meeting of the creditors of the above a statement of affairs was submitted which showed liabilities of £530. The net assets were £289, with a deficiency of £240. It was decided that the estate should be dealt with by Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, London, E.C., as trustee, with a committee of three of the creditors.

T. Priestley, wireless and electrical fittings dealer, 24/26, Westgate, Shipley.—The creditors of the above were called together recently at the offices of Mr. H. M. Dawson, solicitor, 1, Piccadilly, Bradford. The statement of affairs showed ranking liabilities of £901, against assets of £231, with a deficiency of £670. It was decided that the matter should be dealt with under a deed of assignment to Mr. C. H. Baker, accountant, Leeds, with a committee.

Dissolution of Partnership

Morgan & Abbiss, radio dealers and electrical engineers, Radio House, Ystrad Mynach, 11, Hanbury Road, Bargoed, and Radio House, High Street, Blackwood.—Messrs. E. G. Morgan and J. T. Abbiss have dissolved partnership.

Government Contracts in March

THE following contracts were placed by various Government Departments during March:—

Admiralty.

Alternators, motor generator, &c.—Small Electric Motors.
Bells, buzzers, &c.—Bonnella Bros.; Chadburn's Ship Telegraph Co.; A. Graham & Co.; Wm. McGeoch & Co.; Engg. & Lightg. Equipment Co.
Junction boxes, switches, &c.—Laurence, Scott & Electromotors; L. Weekes (Luton); Whipp & Bourne; Engg. & Lightg. Equipment Co.; G.E.C.; Wm. McGeoch & Co.
Branch breakers.—Whipp & Bourne.
Electric cable.—Anchor Cable Co.; B.I. Cables; Connollys (Blackley); Edison Swan Cables; Enfield Cable Works; G.E.C.; Henley's; Hooper's Telegraph & I.R. Works; Johnson & Phillips; Macintosh Cable Co.; Pirelli-General Cable Works; Siemens Electric Lamps & Supplies; St. Helens Cable and Rubber Co.; Standard Telephones.
Electric lighting fittings.—Engg. & Lightg. Equipment Co.; Fairless Engg. Supplies; Gabriel & Co.; G.E.C.; Wm. McGeoch & Co.; Player, Mitchell & Breeden; Rainsford & Lynes; Revo; Sperryn & Co.; Telford, Grier, Mackay & Co.; Veritys.
W.t. fuseboards, &c.—Small Electric Motors.
Electrical fuses.—Engg. & Lightg. Equipment Co.; Reliable Engg. Co.
Fuseholders, fuse elements, &c.—L. Weekes (Luton); Wm. McGeoch & Co.; Parmiter, Hope & Sugden; Engg. & Lightg. Equipment Co.; Dorman & Smith; Bertram Thomas.
Motor generators.—Newton Bros. (Derby).
Electrical installations.—G. E. Taylor & Co.
Electric lamps.—G.E.C.
Searchlight lamps.—Clarke, Chapman & Co.
Lampholders, &c.—G.E.C.; Sperryn & Co.; S. Heath & Sons; Wm. McGeoch; Player, Mitchell & Breeden; Kersons Mfg. Co.; Revo.
Lanterns.—Engg. & Lightg. Equipment Co.; Player, Mitchell & Breeden; Telford, Grier, Mackay & Co.
Electric lift.—Wm. Wadsworth & Sons.
Electric motors.—G.E.C.; Laurence, Scott & Electromotors; Small Electric Motors.
Signalling projectors.—Met-Vick.
Rectifier units, &c.—Small Electric Motors.
Welding resistances.—G.E.C.; Allen West & Co.
Motor-driven rolling platform.—Greenwood & Batley. Sub-contractors for control gear: Allen West & Co.
Switches, &c.—Wm. McGeoch & Co.; J. A. Crabtree & Co.; Engg. & Lightg. Equipment; G.E.C.; Player, Mitchell & Breeden.
Fuse release switches.—G.E.C.; Bertram Thomas; Whipp & Bourne.
Overhead electric travellers.—J. Adamson & Co. Sub-contractors: Laurence, Scott & Electromotors for motors; Allen West & Co. for control gear.
Electric winches.—Sunderland Forge & Engg. Co.
X-ray apparatus.—Philips Lamps.

War Office.

Portable secondary batteries.—Pritchett & Gold & E.P.S. Co.
Electric lamps.—G.E.C.
Electric cable.—Callender's; Henley's; Siemens Bros.; W. T. Glover & Co.; Liverpool Electric Cable Co.; B.I. Cables.
Generating sets.—R. A. Lister & Co.; Ruston & Hornsby.

Air Ministry.

Amplifiers.—A. C. Cossor.
Batteries.—Ever Ready Co. (Great Britain); Siemens Bros.
Electric cable and boxes.—Connollys (Blackley).
Compressors and magnetos.—B.T.H.
Generators.—Newton Bros. (Derby).
Fire alarm apparatus.—Wm. Geipel.
Electric lamps.—G.E.C.; Ceag.
Mask microphones.—Siemens Bros.
Plugs and sockets.—G.E.C.
Switches.—Oliver Pell Control; D. H. Bonnella.
Telephone cable and boxes.—B.I. Cables.
Automatic telephone exchange.—Siemens Bros.
Voltmeters and ammeters.—Met-Vick.
W.t. transmitters.—Standard Telephones.

Post Office.

Telegraph apparatus.—Power Equipment Co.
Telephonic apparatus.—Automatic Electric Co.; Ericsson Telephones; G.E.C.; Hall Telephone Accessories (1928); Plessey Co.; Telephone Mfg. Co.
Testing and protective apparatus.—Chamberlain & Hookham; Everett, Edgcumbe & Co.; G.E.C.; Phœnix Telephone & Electric Works; Power Equipment Co.; Standard Fuse Co.
Cable.—B.I. Cables; Connollys (Blackley); G.E.C.; Hackbridge Cable Co.; Henley's; Standard Telephones.
Leclanché cells.—Ferguson Battery Co.
Secondary cells.—Accumulators of Woking (1928); Britannia Batteries; Tungstone Accumulator Co.
Telephone cords.—B.I. Cables; G.E.C.; London Electric Wire Co. & Smiths; L.P.S. Electrical Co.; Phœnix Telephone & Electric Works; Reliance Elecl. Wire Co.; Siemens Bros.; Standard Telephones.
Rectifiers.—Westinghouse Brake & Signal Co.
Flameproof wire.—Concordia Electric Wire Co.; Lewcos; Macintosh Cable Co.; Reliance Elecl. Wire Co.
Cabling and loading coils.—London-St. Albans-Aylesbury; Yeovil-Shaftesbury: United Telephone Cables. Sub-contractors for London-Aylesbury: Salford Elecl. Instruments for loading coils. Sub-contractors for Yeovil-Shaftesbury: Standard Telephones for loading coils. Kilmarnock-Ardrossan: Siemens Bros.
Cabling, loading coils and terminations.—Wareham-Dorchester: Pirelli-General. Sub-contractors: Salford Elecl. Instruments for loading coils.
Cabling (additional loading).—London-Liverpool-Glasgow (Lancaster-Carlisle repeater section): Pirelli-General. Sub-contractors: Salford Elecl. Instruments for loading coils.
Electric lift.—Southend-on-Sea telephone exchange: Wm. Wadsworth & Sons.
Telephone exchange equipment.—Strood (Chatham); West Kilbride unit; Mitcham & Pollards (London); Southwick (Brighton); Stamford unit: Siemens Bros. Byron, Finchley, Mill Hill and Park (London); London trunk: Standard Telephones. Sub-contractors for Finchley: Electric Construction Co. for motor generator; W. Jones for ringing machines. Sub-contractors for Mill Hill: Chloride Elecl. Storage Co. for batteries; Electric Construction Co. for motor generator; W. Jones for ringing machines. Bishopsgate and Hendon (London); Gloucester; Torquay: Automatic Electric Co. Sub-contractors for Torquay: Alton Battery Co. for batteries. Shepherd's Bush, Clerkenwell and Richmond (London); Bishopwearmouth (Sunderland); Newcastle-upon-Tyne trunk: Ericsson Telephones. Sub-contractor for Richmond: Electric Construction Co. for ringing machines and motor generator. Bowes Park (London); Hull trunk: G.E.C.
Voice frequency telegraph equipment.—Sheffield; Leeds; Inverness; Bristol: Standard Telephones.

H.M. Office of Works.

Electric wiring.—Ministry of Labour training centre, Leicester: E. A. Harvey.

Crown Agents for the Colonies.

Cable.—Callender's; B.I. Cables.
Ceiling fans, &c.—Crompton Parkinson.
Electric crane.—Ransomes & Rapier.
Electrical equipment and telephone apparatus.—G.E.C.
Fire pumps and electric motors.—Gwynnes Pumps.
Petrol electric mobile crane.—H. Morris.
Rectifier equipment.—Hewittic Electric Co.
Wireless apparatus.—Marconi's.
X-ray equipment.—Newton & Wright.

Electricity Supply

Lighting, Domestic, Power

Arbroath.—CHANGE-OVER.—The Arbroath Electric Light and Power Co., Ltd., proposes to extend its cable on the east side of Keptie Road to supply a laundry and bungalows. It is also to lay cables in connection with the change-over to a.c. along East Grimsby, Ladybridge Street, John Street to Union Street East and at the end of High Street and Marketgate.

Ashton-on-Mersey.—LOWER CHARGES FOR ASHTON.—The Sale Borough Council has decided to reduce the price of electricity in the area to the same as in Sale, despite the heavy capital charges on the Ashton undertaking. It is recalled that the Council was recently involved in lengthy litigation in connection with the purchase of the undertaking of the Altrincham Electric Supply Co., Ltd., in Ashton-on-Mersey, which was only settled on an appeal by the latter to the House of Lords, which affirmed the company's contention that the purchase price should be £109,000 and not £55,000, as claimed by the Council according to the terms of an agreement. The Council had powers under a Special Order to make differential charges in Ashton for as long as five years.

Barnet.—MODERNISING A HOSPITAL INSTALLATION.—The electrical installation at the Wellhouse Hospital is to be modernised at a cost of £2,000, in accordance with recommendations by Mr. F. C. Raphael, consulting engineer.

Barrow-in-Furness.—NEW MAINS.—Sanction has been obtained by the Electricity Committee to a loan of £12,167 for mains extensions from Blawith to Coniston and Hawkshead.

Berwick (Northumberland).—OWNERSHIP OF UNDERTAKING.—The Southern Scottish Electric Supply Co. is negotiating with the Berwick Urban Electric Supply Co. with a view to purchasing its undertaking. The sanction of the Town Council is necessary.

Bowes (Durham).—REQUEST FOR ELECTRICITY SUPPLY.—At a parish meeting it was decided to ask the North-Eastern Electric Supply Co., Ltd., to extend its mains to the district. Since then a reply has been received that the scheme would involve an outlay of £3,000, which was not justified by the estimated income. The prospects, however, could be materially altered if the L.N.E.R. would electrify its stone quarries at Hulards. It has therefore been decided to seek the co-operation of the railway company.

Burnley.—SPECIAL TARIFF FOR SHOPS.—A new tariff for lock-up shops has come into operation whereby traders can elect to be charged on maximum demand as follows: £10 per kW per annum for lighting up to 25 kW, and £8 per kW over 25 kW, plus a charge of 0.6d. per kWh.

Burton-upon-Trent.—HIRE OF WATER-HEATING APPARATUS.—Hitherto, water-heating apparatus has only been obtainable at the municipal electricity showrooms on hire-purchase terms or for cash, but in view of the numerous inquiries for such equipment it has been decided to introduce a hire scheme. For electric immersion heaters the rental will be 2s. 6d. where an electric cooker is installed, or 3s. otherwise, while small thermostatically controlled water heaters for sink use are to be hired at 2s. 6d. per quarter.

Carlisle.—CABLE-LAYING PROPOSALS.—The City Council is to spend £1,883 on replacing the cable between Etterby Road and Millbourne sub-station and £1,680 on other electricity cable extensions.

Chester.—MAINS AND SERVICES.—The Corporation Electricity Committee has obtained sanction to borrow £5,000 for mains and services and £1,000 in connection with the supply to the Mouldsworth pumping station.

Darlington.—NEW FEEDERS.—Sanction to borrow £3,353 for the laying of feeder cables has been received by the Town Council.

Devizes.—OVERHEAD LINES.—No objection is being offered by the Rural District Council to the erection of overhead lines at Nursteed and Marsh Lane, Rowde, by the West Wilts Electric Light and Power Co., Ltd.

Dunblane.—ALL-ELECTRIC HOUSES.—The Town Council has decided to provide complete electrical installations (lighting, heating and cooking) in its new houses at Hillside.

Dunfermline.—ELECTRICITY FOR COUNCIL HOUSES.—Quotations have been received by the Housing Committee from electrical contractors for the installation of electric lighting in 427 houses at Brucefield, Whirlbut and Townhill at present lighted by gas.

Epping.—LOWER CHARGES.—The County of London Electric Supply Co. has informed the Urban District Council that the "unit" charge under the domestic and business two-part tariffs has been reduced from 1d. to ¾d.

Great Yarmouth.—NEW TRANSFORMER.—Tenders are to be obtained by the Electricity Committee for a duplicate installation of the existing 15,000-kVA transformer at the power station.

Leyburn (Yorkshire).—OVERHEAD LINES.—Plans submitted by the North-Eastern Electric Supply Co., Ltd., for overhead electric network at Harmby have been approved by the Leyburn Rural District Council.

Linlithgow.—ELECTRICITY FOR MUNICIPAL TENANTS.—It was reported at a recent meeting of the Town Council that the Scottish Midlands Electricity Supply, Ltd., had completed a canvass of the tenants of municipal houses in Philip Avenue, St. John's Avenue and Preston Road, sixty-eight signatures having been obtained. Most of the tenants wished to take advantage of the two-part tariff, indicating a desire to use electricity for purposes other than lighting. The company notified its intention of laying the necessary cables and the Council agreed to proceed with the wiring of the houses.

London.—BATTERSEA.—The Electricity Committee has arranged for the provision of electricity services in ninety premises at a cost of £712, and is to provide an additional 250-kVA transformer at Wandsworth Common (£232), a 500-kVA transformer with switchgear at Grayshott Road sub-station (£923), and two 500-kVA transformers with switchgear at the Southern Railway Co.'s granary at Nine Elms (£1,768).

HAMMERSMITH.—A two-part tariff for domestic supplies through prepayment meters is recommended by the Electricity Committee. Under this, the fixed charge would be 7½ per cent. per annum of the rateable value, or, in the case of premises not separately assessed, £6 per kW of lighting installed per annum, the "unit" charge being ½d.

HIRE-PURCHASE OF REFRIGERATORS.—It is proposed to introduce a scheme for the supply of 3½ cu. ft. electric refrigerators on hire-purchase over a period of five years, the charge to be 2s. 6d. per week, or for a lesser period *pro rata*.

Lowestoft.—LOAN.—The Town Council has received sanction to a loan of £13,000 for electricity purposes.

Norway.—A 60-kV RING MAIN.—One of the first cities in Europe to adopt the ring-main system was Oslo, the Norwegian capital, which completed its network with 30-kV cables as long ago as 1921. Quite recently there has been completed a section of a 60-kV ring system, which is destined, when fully developed, to supersede the 30-kV ring, and to link up the two h.v. overhead transmission lines at Smestadt (West Norwegian power station) and Toyen (East Norwegian power station). Apart from supplying the demands of the city the cable is used for the transmission of energy from east to west or *vice versa*. For the time being and pending the final development of the system, which is to be effected in several stages, the 60-kV compound insulated cables which have been supplied by three German concerns (Siemens-Schuckert, A.E.G. and Felten & Guilleaume) are only being operated at 20 kV, and thus form a reinforcement of the existing network.

Paisley.—LOAN.—The Electricity Commissioners have sanctioned the borrowing of £35,703 by the Corporation as follows: Meters, £5,000; hired appliances, £15,000; additional transformer and switchgear, £675; additional transformers, £1,350; and distribution extensions, £13,678.

Portrush.—MUNICIPAL UNDERTAKING SOLD.—The sale of the electricity undertaking to the Antrim Electricity Supply Co. for £25,000 was completed at a special meeting of the Urban District Council recently.

Rhyl.—ILLUMINATIONS.—A scheme of electrical illuminations

Municipal Supply Undertakings' Results

Town.	Engineer.	Total Revenue.		Working Expenses.		Net Profit.		Sales of Electricity. Thousands of kWh		Percentage Increase.
		1933/34.	1934/35.	1933/34.	1934/35.	1933/34.	1934/35.	1933/34.	1934/35.	
		£	£	£	£	£	£			
Bury	J. G. Potts	131,709	126,267	63,182	*104,462	8,519	5,186	30,619	31,815	3.9
Croydon	F. N. Rendell-Baker	474,901	460,007	111,827	96,988	41,765	37,007	†81,003	†84,599	4.4
Eccles	H. W. Angus	55,985	62,553	36,569	43,091	6,941	6,630	9,589	11,107	15.8
Great Yarmouth	P. E. Rycroft	146,767	152,728	51,323	82,549	20,250	9,257	22,020	24,082	9.4
Harrogate	N. McLean	107,542	118,529	54,163	57,548	17,917	23,440	14,547	16,979	16.7
Horsham	F. Ffrench	26,569	29,546	14,307	18,031	3,111	1,445	2,306	2,741	18.9
King's Lynn	C. W. Jackson	51,072	57,315	20,989	25,239	6,049	8,135	7,001	8,766	25.2
Mansfield	E. F. J. H. Hewlett	—	63,019	—	40,479	—	4,351	—	6,605	—
Southend-on-Sea	A. C. Johnson	253,608	281,351	219,185	172,566	47,103	70,251	31,390	38,894	23.9
Stepney	A. E. Campbell	441,811	476,593	202,396	206,212	24,743	52,155	80,889	83,159	2.8
Taunton	A. J. Howard	44,554	49,001	25,937	30,459	5,952	5,197	5,932	6,648	12.1
Tynemouth	J. B. Glen	69,870	74,733	38,630	44,222	2,878	2,258	8,899	9,962	11.9

* Includes electrical energy purchased from the Central Electricity Board.
† Excluding electricity exported to the C.E.B.

for the forthcoming summer season at a cost of £1,322 has been approved.

Stoke-on-Trent.—CHANGE-OVER.—Application is to be made for sanction to borrow £2,250 for carrying out the change-over from d.c. to a.c. in the Church Street, Glebe Street and Boothen Road area, one of the few parts of the city remaining to be dealt with.

SUB-STATIONS.—Plans for a sub-station in Belmont Road, Etruria, have been approved by the Electricity Committee; negotiations are in progress for the site of a new sub-station in Sutherland Road, Longton. Franklyn Street (Hanley) sub-station is to be extended, and application is to be made to the Electricity Commissioners for sanction to borrow £3,250 for e.h.v. and l.v. mains and l.v. switchgear for the Porthill sub-station to meet the prospective demand from the development of the Bradwell Farm Estate, Wolstanton.

SUPPLY TO CORPORATION HOUSES.—Consequent upon the growth of the load in the Bucknall area, application is to be made for sanction to borrow £3,000 for the provision of mains

Both the roadway and houses are brightly illuminated by the new Siemens "Sieray" electric-discharge lighting, utilising "Gower-Sieray" lanterns, at Albany Street, London, N.W.1

to 262 Corporation houses which are in course of erection.

PLANT AND MAINS.—The Electricity Commissioners have sanctioned loans of the following amounts: £3,350 for sub-station plant and mains, Hoon Avenue, Wolstanton; £2,650 for plant and mains, Whieldon Road sub-station, Fenton; £8,600 for plant and mains for the improvement of the supply in the Longport and Brownhills areas; £10,750 for mains for improvement of supply in East Longton and Sandford Hill.

Swindon.—EXTENSION.—A loan of £3,810 for an electricity supply by the Corporation to the Walcot estate has been sanctioned.

Torquay.—DEVELOPING THE H.V. NETWORK.—A firm of consultants is to be engaged to collaborate with the electrical engineer in the preparation of a scheme for the future development of the h.v. network.

Wallsend-on-Tyne.—SUB-STATION.—The North Eastern Electric Supply Co., Ltd., is to erect a sub-station on the Westmoreland estate.

Walton and Weybridge.—LOAN.—The Urban District Council is to apply for sanction to a loan of £14,600 for the development of the electricity undertaking.

Whitby.—REVISED CHARGES.—The Urban District Council has revised its charges as from April 1st as follows:—Lighting, reduced from 5d. to 4d. per kWh for consumption between 500 and 1,000 kWh per quarter, and to 3d. per kWh over 1,000 kWh. Power, first 100 kWh per quarter at 3d. (as before); 1½d. per kWh for the next 500 kWh (instead of 2d.), and 1d. (instead of 2d.) beyond. Slot meter tariff (lighting) reduced by 1d. per kWh.

Whitehaven.—LOWER CHARGES.—The Corporation has reduced its "unit" charge to shopkeepers, stores, &c., on the maximum demand rate from 2d. to 1¾d., and on the domestic rate from ¾d. to ½d.

Wigtownshire.—ELECTRICITY FOR SCHOOLS.—The Education Committee is to consider a proposal to install electricity in schools and schoolhouses.

Wolverhampton.—NEW MAINS.—A scheme for the provision of additional feeders and switchgear at a cost of £18,496 has been approved by the Electricity Committee.

Traction

Austria.—HIGH-SPEED VEHICLES.—A number of light-weight motor-coaches have recently been acquired by the Austrian Federal Railways for service with speeds up to 80 m.p.h. on the single-phase electrified system. The hourly output is 540 h.p. and the weight 47 tons. A special party was recently taken from Vienna to Badgastein and back in a day by using a steam engine from Vienna to Salzburg and then by one of the new cars over the mountain line to Badgastein. This was the first time that such a return trip has been possible, and speeds up to 83 m.p.h. were recorded.

Belgium.—NEW ELECTRIC GOODS LOCOMOTIVES.—Although electric passenger trains have been running on the railway between Brussels and Tervueren since the beginning of 1935 it is only lately that electric engines have been brought into operation for the haulage of goods trains. A number of special engines for this purpose have been built by the Société des Ateliers des Constructions Electriques de Charleroi. Each locomotive is provided with four 250 h.p., 1,500 V, d.c. motors; they each weigh 65 tons in running order, and are capable of hauling a 300-ton train at about 45 m.p.h. Each bogie is driven by a twin motor comprising two armatures supplied at 750 V; while connected together in series the four motors are so arranged that they may be placed in series-parallel or in parallel. The control gear is of the electro-pneumatic type operating at 36 V, the necessary power being furnished by a 1,500/36 V motor-generator. A 36-V battery of nickel-cadmium cells is provided for emergency purposes.

Cleethorpes.—PURCHASE OF TRAMWAYS.—After six years of negotiation agreement has been reached for the purchase of the local tramways by the Council for £50,000. It is proposed to substitute trolley-buses for the trams, and to arrange with the Grimsby Corporation to run joint services.

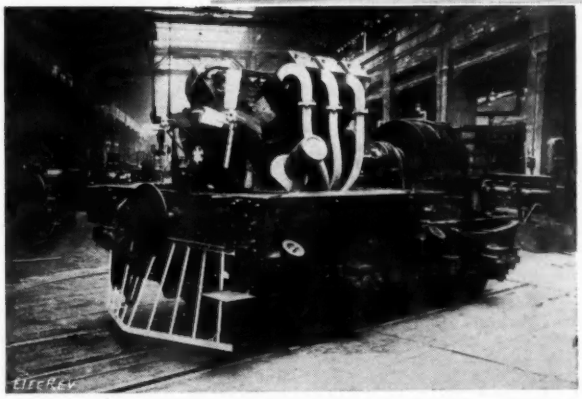
Holland.—ELECTRICAL SIGNALLING.—Details are given in the *Railway Gazette* of a new power signalling installation recently brought into service at Maastricht station, where lines from Belgium and Germany converge. One new signal cabin has taken the place of three mechanical ones, and by means of an advanced form of multiple row locking frame no fewer than 168 levers, or handles, inclusive of fifteen spare spaces, are concentrated in an area of 8 ft. 10 in. by 3 ft.

Italy.—MORE ELECTRIFICATION.—The Italian Minister of Communications recently announced that the following lines had been authorised for immediate electrification: Milan-Bologna (3,000 V d.c.) and Milan-Domodossola and Milan-Chiasso (3,600 V three-phase). The Gorizia-Udine line in north-east Italy has been opened to electric traction.

Lancashire.—TRANSPORT MERGER SCHEME.—Since the Stockport, Bury, Bolton, Stalybridge and Rochdale authorities have withdrawn their support for the proposed South-East Lancashire transport merger, leaving only Manchester, Oldham and Salford in favour of it, the scheme is likely to be shelved unless the Government intervenes.

London.—"MET" AND "BAKERLOO" INTERCONNECTION.—The extension of the Bakerloo "tube" from Baker Street to link up with the Metropolitan line at Finchley Road was begun last week. The cost is estimated at £2,000,000.

Poland.—EXPERIMENTAL RAILCAR.—A Diesel-electric railcar with Gebus transmission has been put into service on the State



The new Polish Diesel-electric railcar (top) and an interior view showing the Diesel engine and directly connected Elin Gebus generator

Railways, and, if satisfactory, this type of unit will eventually replace the present steam trains. The Diesel engine, directly coupled to a generator, is contained in a housing at one end of the car so that the various parts are easily accessible. The six-cylinder 240 h.p. Diesel Ebermann runs at 800 r.p.m. on full load. The Elin Gebus generator produces 147 kW at 335 V and feeds the two traction motors

through a reversing apparatus that permits the feed to be for either forward or backward running. The two traction motors, each rated at 90 h.p., are built into the bogie below the generator, and run at 1,020 r.p.m They are connected to the generator in parallel, and to the driving shafts through gearing. The operation of the car is entirely by control of the Diesel engine, which is connected by relays to the generator. When the speed drops to 400 r.p.m. a relay which is coupled with the operating lever short-circuits the field of the generator.

As a measure of safety there is an arrangement of two knobs and a foot pedal, one of which has always to be pushed down. Only when all three are released does the time relay come into operation. This can be regulated so that after from 3 to 11 seconds the relay opens the controls to the Diesel, putting them at their no-load position, at the same time closing the emergency brake to stop the car. The lighting is obtained from batteries which are kept charged by a second generating unit.

Portugal.—LISBON TRAMWAYS.—Definite proposals are on foot to carry the Lisbon tramways underground in the Baixa district in two tunnels, the first 820 yd. and the second 950 yd. long, in order to relieve traffic congestion. The plans which have recently been drawn up include a parallel subway for pedestrians.

Sweden.—ELECTRIC ROLLING STOCK.—A survey, made on January 1st, of the rolling stock of the Swedish State Railroads, reveals that there are 120 electric engines for fast trains, 108 for freight trains, 44 electric tractors for shunting work, and a number of battery-operated types. It is learned that at the present time the staff is experimenting with a new type of shunting engine with convertors and accumulators for combined operation on tracks with and without overhead lines. Altogether 2,600 km. of the State Railway lines has been electrified, representing about a third of the total length of State lines, and between now and June, 1937, it is probable that another 753 km. will be converted to electric traction.

Communications

French West Africa.—NEW SUBMARINE TELEGRAPH CABLE.—A submarine telegraph cable has recently been laid by the French steamer "Arago," between the Ivory Coast and Dahomey in place of one laid in 1886.

Great Britain.—AUTOMATIC TELEPHONES.—It is reported that twenty-two new automatic exchanges are to be provided in the London area and fifty-two in the provinces. The first new London area exchange to be opened will be "Uplands," to serve the Purley district as from April 29th. It will accommodate 5,677 lines, and additional equipment can be added to provide for nearly 10,000 lines. This will be the fifth automatic exchange opened under the Post Office policy of extending the London automatic system from 10 to 12½ miles radius of Oxford Circus.

"HOUSE EXCHANGE."—A new telephone exchange known as the "House Exchange" has been introduced by the Post Office, making possible a direct call for an internal telephone to the public exchange without the help of the house switchboard.

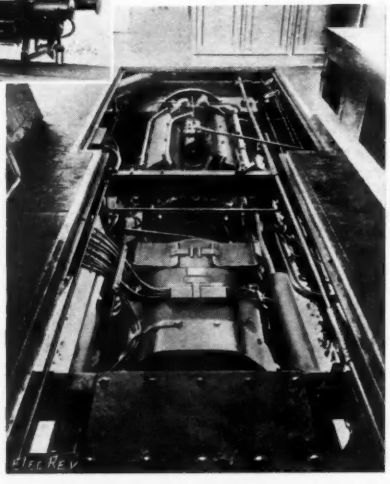
RADIO LICENCES.—During the past year there has been an increase of 606,044 radio licences as compared with a year ago, there being 7,617,797 in force at the end of March.

Liverpool.—CHANGE-OVER TO AUTOMATIC TELEPHONES.—Plans have been made for changing over the 86,000 telephones in the Liverpool district to the automatic system. The Post Office has acquired a site in Oldhall Street for the erection of a building to be known as Telephone House, which, when completed in 1938, will accommodate the whole of the area staff of telephone operators and the switchboard, which will occupy 24,000 sq. ft.

Spain.—TELEPHONE PROGRESS.—According to preliminary figures issued by the Compania Telefonica Nacional de Espana, 140 new exchanges were opened during last year, bringing the total in the country up to 3,090. Telephone subscribers in Spain are now linked with sixty-eight countries.

Inspecting Railway Overhead Conductors in Germany

THE accompanying illustrations depict an overhead conductor inspection vehicle recently put into service by the German State Railway Exploitation Co. on the electric railway between Augsburg and Stuttgart. The mechanical portion of the vehicle was constructed by the Esslingen Maschinenfabrik, of Esslingen, while the electrical equipment was supplied and installed by the Brown-Boveri Co., of Mannheim. The motive power is supplied by a Maybach V-type, twelve-cylinder petrol engine, which develops 165 h.p. at 2,600 r.p.m., and is flexibly coupled to a main generator that supplies power to a nose-suspended motor having a one-hour rating of 160 kW and separate fan ventilation. One of the two axles is driven through spur gearing having a ratio of 1 to 3.48, the diameter of the driving wheels being approximately 39¾ in. The one-hour tractive effort is 1,740 kg., and the maximum starting effort 3,200 kg. In running order the vehicle weighs nearly 23 tons, while the maximum speed is 47 m.p.h.



The vehicle used for inspecting overhead conductors on the electric railway between Augsburg and Stuttgart, and (below) the engine and transmission in the undercarriage

A dynamo, directly coupled to the main generator, is provided to supply power for the auxiliary services, such as lighting, battery charging, separate excitation of the main set, &c.

The main generator has a counter-compound winding; a shunt field winding, which is not regulated, is also utilised to keep the working range of the power regulator inserted on the separate excitation as low as possible. The driver's hand wheel controls the speed governor of the engine through the agency of a cable, which allows the speed to be varied between 1,200 and 2,600 r.p.m. A separate lever is provided to throttle down the speed to 600 r.p.m. for idling.

As the amount of current taken by the driving motor is determined by the tractive effort demanded (which, in its turn, depends on the train load and the gradient being negotiated), the voltage of the main generator must be altered according to the engine power available. This is effected by means of a Brown-Boveri quick-acting regulator, which controls the separate excitation. The output of the generator which the power regulator holds constant has also to correspond always with that developed by the engine at any particular setting of the throttle. This condition is met by actuating two rheostats by the same cable as that which regulates the speed governor of the engine. The two rheostats vary the resistance in the circuit of the voltage coil and in that of the current coil of the quick-acting regulator, so that the latter adjusts the output to the desired figure.

The control equipment, apart from its regulating capabilities, is claimed to have the advantage of taking up little space and of being very light in weight. The regulator and its resistances are under a bench inside the vehicle; otherwise, the whole of the plant is under the floor of the vehicle. The specification of the machine required that, using the type of control described above, the output, to be held constant, should be about 109 kW in the highest step and 6 kW in the lowest.

The vehicle is of a strictly utilitarian character, the bodywork including compartments for the storage of material and for the accommodation of the electrical workmen. On the roof, extending the full length of the van, is a railed platform enabling a good length of the conductor to be dealt with at a time. As a direct result of the satisfactory performance of the first vehicle, the German State Railway Exploitation Co. has recently ordered three more, all to be fitted with the Brown-Boveri type of electrical control mechanism.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aldershot.—May 5th. Borough Council. Cables and meters for the year ending March 31st, 1937. (See this issue.)

Barnes.—May 12th. Corporation. Cables. (See this issue.)

Beckenham.—April 27th. Borough Council. House service cut-outs from May 1st, 1936, to March 31st, 1937. (April 10th.)

Bexhill.—May 5th. Electricity Department. E.h.p. and l.p. switchgear. (April 10th.)

Birmingham.—May 7th. Committee of Visitors of the Mental Hospital. X-ray apparatus at the Hollymoor Mental Hospital, Northfield. (April 17th.)

May 5th. Electric Supply Committee. Meters as required between June 1st and December 31st, 1936. (See this issue.)

Burton-on-Trent.—April 30th. Corporation. H.p. and l.p. cables, switchgear and transformers. (See this issue.)

Coatbridge.—May 18th. Town Council. Various works, including electrical, heating and ventilating installations and filtration plant at the new public baths, municipal swimming pond and public health offices. Town clerk, Municipal Buildings (deposit £2 2s.).

Cowdenbeath (FIFE).—May 1st. Town Council. Electrical work at 112 houses. C. A. Alexander, borough surveyor (deposit £2 2s.).

Dagenham.—May 2nd. U.D.C. Electrical installation and water heating at the new Becontree branch library. (April 17th.)

East Africa.—LOURENCO MARQUES.—May 21st. Mozambique Ports and Railways Administration. One 25-kVA, 3-phase, 50-cycle alternator, exciter, control and distribution switchboard and accessories. (T.Y. 40023.)*

Eccles.—April 27th. Electricity Supply Committee. Two 500-kVA, 3-phase oil-cooled transformers and a metal-clad ring main e.h.p. switchgear control unit. Borough electrical engineer, Electricity Offices, 1, King Street.

Fife.—May 2nd. District Asylum Works Department. Electrical fittings for one year. Resident clerk of works, Fife District Asylum, Cupar.

Finchley.—May 25th. Electricity Department. One rotary balancer set complete with automatic starting panel and glass bulb mercury arc rectifiers. (April 17th.)

Glasgow.—May 11th. Corporation. Cables, flexibles, meters and cable covering tiles for the year ending May 31st, 1937. (See this issue.)

Hastings.—April 30th. Electricity Department. Switchboard and two transformers. (April 3rd.) Electric cookers during the period from May 16th, 1936, to March 31st, 1937, and boiler fuel for use on mechanical stokers during the year ending June 30th, 1937. (April 17th.)

Hove.—May 4th. Electricity Department. One 200-kVA and one 400-kVA transformer. (See this issue.)

Inverkeithing (FIFE).—April 28th. Town Council. Electric lighting at fifty-six houses. R. H. Motion, architect, Union Bank Chambers, Dunfermline (deposit £1 1s.).

Lanarkshire.—April 28th. County Council. Various works, including electrical, at 300 houses. P. C. Smith, County housing and town planning engineer, 13, Clydesdale Street, Hamilton.

London.—ISLINGTON.—June 10th. Borough Council. Street lamp columns, emergency battery, installation of fire-resisting apparatus in connection with new switchgear and transformers. (April 3rd.)

STEPNEY.—April 27th. Electricity Department. Electrical materials for one year. (April 3rd.)

LONDON AND HOME COUNTIES J.E.A.—May 11th. Transformers for one year. (April 17th.)

ST. MARYLEBONE.—April 28th. Borough Council. Cables during the twelve months ending May 31st, 1937. (April 17th.)

Manchester.—May 5th. Electricity Committee. 6.6-kV, 3-phase, a.c., metal-clad switchgear for the Brown Street substation. (See this issue.)

Middlesex.—May 13th. County Council. Electrical installation, comprising wiring for lighting, power and clock services at the Local County Offices, Brentford. (April 17th.)

Morley.—May 4th. Housing Committee. Various works, including electrical, at twenty houses to be erected on the Baker Street estate. Borough engineer, Town Hall (deposit £2 2s.).

New Zealand.—WELLINGTON.—June 5th. Post and Telegraph Department. Eight miles of single solid conductor rubber-insulated taped and braided cable. (T.Y. 10447.)*

June 8th. One 17-kVA power-factor correction condenser. (T.Y. 40028.)*

Ormskirk.—April 25th. U.D.C. Electrical pumping plant at the Greetby Hill waterworks. J. Haydn Thomas, clerk to the Council (deposit £3 3s.).

Portsmouth.—May 19th. Electricity Undertaking. Reconstruction of the existing 6,600-V metal-clad switchgear at the power station to increase its rupturing capacity. (See this issue.)

Rochdale.—May 11th. Electricity Department. Two 33,000-V feeder cables and two pilot cables. (See this issue.)

Rowley Regis.—April 25th. Corporation. Electric lighting installations in the Old Hill and Blackheath Libraries. Borough surveyor, Haden Hill Park Offices, Old Hill, Staffs.

Settle.—April 27th. County Council of the West Riding of Yorkshire. Electric lighting at the Girls' High School. Education officer, County Hall, Wakefield.

Sheffield.—May 11th. Electricity Committee. Steam shunting locomotive and natural draught concrete cooling towers. (See this issue.)

South Africa.—JOHANNESBURG.—May 5th. Rand Water Board. One 3,000-kW steam turbine driven alternator with auxiliaries, &c., and switchgear. (T.Y. 40017.)*

Railways and Harbours. Diesel-electric shunting locomotives. (T.Y. 30066.)*

PRETORIA.—May 29th. Union Tender and Supplies Board. Galvanised iron telegraph arms and pole fittings, &c. (T.Y. 40037.)*

Stoke-on-Trent.—May 6th. North West Midlands Joint Electricity Authority. Outdoor type static transformers with on-load tap-changing equipment. (April 17th.)

Tynemouth.—May 2nd. Town Council. Automatic on-load tap-changing transformer. J. B. Glen, Electricity Works.

Uruguay.—MONTEVIDEO.—May 12th. State Electricity Supply and Telephones Administration. Insulated copper conductors for outdoor use. (T.Y. 10446.)*

June 15th. P.i. l.c. steel tape, armoured underground cables. (T.Y. 40039.)*

Weymouth and Melcombe Regis.—April 27th. Electricity Department. Cables. (April 17th.)

May 11th. Town Council. Automatically operated electrically driven pumping plant and incidental works at pumping stations. M. G. & R. W. Weeks, 75, Victoria Street, London, S.W.1 (depcsit £5 5s.).

Wigan.—May 11th. Electricity Department. Cables for one year. (April 10th.)

Willesden.—April 27th. Corporation. Six-body mortuary cabinet with electrical refrigerating equipment, trays and racks and four electric refrigerators. (April 17th.)

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Ayrshire.—County Council. Accepted. Electric lighting in forty-four houses at Catrine.—W. Ross, Kilmarnock.

Barrow-in-Furness.—Electricity Committee. Recommended. Switchgear for sub-station replacements (£3,140).—B.T.H. Switchgear for Bridge Approach sub-station (£882) and kiosk for Furness Park estate (£211).—Met.-Vick.

Accepted. Supplies for twelve months: Turbine and transformer oil.—W. B. Dick & Co.; R. D. Nicol & Co.; C. C. Wakefield & Co. Meter boards.—Wootton & Co. Wire, strip and cables.—B.I. Cables. Tapes.—Pirelli-General. Insulating compounds.—Dussek. Switch cut-outs.—Prentice, Ltd. Switch cut-outs, cables and flexibles, lampholders and ceiling roses, conduit and fittings, wiring supplies, fuse boards, and ironclad cut-outs.—W. R. Thornton. Meters.—Landis & Gyr; Chamberlain & Hookham; Measurement; Met.-Vick. Pipes, bends and tee boxes.—Albion Clay Co. Tiles.—Cable Covers, Ltd. Transformers.—British Electric Transformer Co. Disconnecting boxes, &c.—Callender's. Disconnecting and terminal boxes.—Henley's. Insulators.—Electric Transmission, Ltd. Cables.—Derby Cables, Ltd.; Mersey Cable Works. Switch sockets and plugs, switches and wood blocks.—Downes & Davies. Cooker control units.—J. H. Tucker & Co. Electric kettles.—Premier Electric Heaters. Electric cookers.—English Electric Co.; Revo; Hotpoint; Tricity Cookers.

Bedford.—Electricity Committee. Accepted. Electric vehicle (£226).—Partridge, Wilson & Co.

Bromley.—Town Council. Accepted. Wiring and fitting houses and flats on the Turpington estate.—W. F. Rogers (West Wickham).

Chesterfield.—Electricity Committee. Accepted. Switchgear (£758).—English Electric Co. Cable (£285).—Macintosh Cable Co.

Dartford.—U.D.C. Accepted. Cable (£1,266).—Hackbridge Cable Co.

Glasgow.—Transport Committee. Accepted. Battery for underground section locomotive.—Fuller Accumulator Co. (1926), Ltd.

Great Yarmouth.—Electricity Committee. Accepted. Meters.—R. Hornby; Chamberlain & Hookham; Met.-Vick. Transformers.—Bruce Peebles. Cookers.—Jackson; Hotpoint.

London.—ISLINGTON.—Electricity Committee. Recommended. Conversion of further street lighting from gas to electricity: 300 fittings with Venner time switches.—Revo Electric Co.

BATTERSEA.—Electricity Committee. Accepted. Supplies for eleven months: Wiring accessories and switch plugs.—W. White & Co. Switches.—J. A. Crabtree & Co. Ironclad cut-outs, &c., and cooker control boards.—Foster Engineering Co. Conduit and conduit fittings.—Mosers, Ltd. Cookers.—Jackson. Water heaters.—Heatrae, Ltd. Wash-boilers.—Brailsford Bros. Irons—Revo. Glass shades.—Falk, Stadelmann & Co.

HAMMERSMITH.—Electricity Committee. Recommended. Additional switchgear at the Wood Lane sub-station (£711).—A. Reyrolle & Co. 11,000V e.h.p. cable (£1,098).—Standard Telephones.

L.C.C.—Wiring and fittings for electric lighting, &c., in 294 additional houses (No. 3 contract) on vacant sites at Becontree:

	£
T. B. Watson & Son (Accepted)	**2,573**
Evans & Shea	2,699 (after correction.)
Samuel Reed & Sons	2,808
Read & Partners, Ltd.	2,877
Pinching & Walton	2,880
Francis Polden & Co., Ltd.	2,894
Henfrey Electrical Installations	2,986
Ryland's Electrical Co., Ltd.	3,078
Ilford Electrical Co., Ltd.	3,097
Bower Engineering Works (Electrical and General), Ltd.	3,180
Twentyman & Willmott, Ltd.	3,203
A. Higginbotham & Sons	3,953
Springvale Electrical Co.	3,968
Smith & Hammond, Ltd.	4,366
Higgs & Hill, Ltd.	4,912

Electric lighting, &c., at the Wandsworth Technical Institute extension:

	£
Buchanan & Curwen, Ltd. (Accepted)	**3,097**
Archibald Meckhonik	3,397
W. H. Gaze & Sons, Ltd.	3,496
Twentyman & Willmott, Ltd.	3,521
G. E. Taylor & Co.	3,547
Pinching & Walton	3,696
Jacob White & Co., Ltd.	3,702
City Electrical Co.	3,749
Barlow Bros. & Co.	3,839
Electrical Installations, Ltd.	3,840
Harland & Wolff, Ltd.	3,969

Wiring and fittings for electric lighting, heating and power at the West Kensington Central school, Fulham:

	£
Bower Engineering Works (Electrical and General), Ltd. (Accepted)	**1,005**
Evans & Shea	1,051
Twentyman & Willmott, Ltd.	1,114
Jacob White & Co., Ltd.	1,203
Anderson Angell & Co.	1,231
J. H. Plant, Ltd.	1,257
City Electrical Co.	1,269
Berkeley Electrical Engg. Co., Ltd.	1,277

Wiring and fittings for electric lighting and heating at the Wickham Lane school:

	£
Berkeley Electrical Engg. Co., Ltd. (Accepted)	**870**
Pemberton & Sturgess (Great Britain), Ltd.	876
Arthur Cozens	975
E. & C. Champion	985
J. L. Shadwell	987
C. H. Fstall	998
J. H. Plant, Ltd.	1,032
Woolwich Borough Council	1,104
Cox-Walkers	1,144
Higgs & Hill, Ltd.	1,200
E. W. Merredew	1,381
Bell Bros. & Co. (London), Ltd.	1,406
E. C. Stokes, Ltd.	1,539

Paisley.—Corporation. Accepted. Cables (£4,820).—W. T. Glover & Co. Transformers (£1,994).—Electric Construction Co.

Redcar.—Electricity Committee. Accepted. Cables (224).—Johnson & Phillips.

South Shields.—Cleansing Committee. Accepted. Two electric vehicles (£1,170).—Electricars, Ltd.

Stockton-on-Tees.—Town Council. Accepted. Electric lighting at the Norton temporary school.—T. B. Watson & Sons.

Walsall.—Gas Committee. Recommended. Modernising the electrical equipment at Pleck gasworks (£862).—Mechanical & Electrical Engineering Co.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, April 30th. Institution, London, W.C.2. 6 p.m. "Main Line Electrification Throughout the World, with special reference to the Austrian Federal Railways." Mr. E. R. Kaan.

London Students' Section.—Tuesday, April 28th. Institution, London, W.C.2. 7 p.m. Address by Mr. J. M. Kennedy.

Meter and Instrument Section.—Friday, May 1st. Institution, London, W.C.2. 7 p.m. "Uniformity as the Gauge of Quality." Mr. C. C. Paterson. Saturday, May 2nd. Summer visit to Oxford and district.

Birmingham Electric Club.—Friday, April 24th. Grand Hotel, Birmingham. 7 p.m. "Cinema Equipment." Messrs. J. H. Asdell, J. Bryant and P. C. Batston.

Institution of Engineers-in-Charge.—Friday, April 24th. Holborn Restaurant, London, W.C.2. Annual dinner.

Institution of Mechanical Engineers.—Friday, April 24th. Institution, London, S.W.1. Second report of the Welding Research Committee.

Society of Chemical Industry (*Chemical Engineering Group*).—Friday, April 24th. Waldorf Hotel, London, W.C.2. 6.45 p.m. Annual general meeting and dinner.

Diesel Engine Users' Association.—Tuesday, April 28th. Caxton Hall, London, S.W.1. 5 p.m. Informal discussion on "The Horizontal *versus* the Vertical Oil Engine."

Institution of Civil Engineers.—Wednesday, April 29th. Savoy Hotel, London, W.C.2. 7.15 for 7.45 p.m. Annual dinner. (Postponed from Wednesday, March 4th.)

Electrical Engineers' Dance.—Friday, May 1st. Grand Hotel, Harrogate. 8 p.m.

Physical Society.—Friday, May 1st. Imperial College of Science and Technology, London, S.W.7. 5 p.m. Short papers.

Notes

Transport Congress at Brighton

The twenty-sixth annual congress of the Tramways, Light Railways and Transport Association will be held this year at Brighton from June 10th to 12th. A golf tournament at Hollingbury Park has been arranged for the first day (Wednesday), this being followed in the evening by an informal reception at the headquarters, the Hotel Metropole, by Mr. T. E. Thomas, chairman of the Council. On Thursday, after the official reception by the Mayor of Brighton (Coun. E. Denne), the annual general meeting is to be held, when Mr. A. T. Priddle, of the Associated Equipment Co., Ltd., will read a paper on "Some Aspects of Trolley-bus Developments." After lunch there will be a motor-coach excursion to Arundel and Worthing, the evening being taken up by the annual dinner and dance at the Hotel Metropole. "Merchandising Passenger Transportation" is the title of a paper to be given by Mr. A. A. Jackson, general manager of the St. Helens Corporation Transport Department, on Friday morning. Alternative visits are planned for the afternoon, either to Eastbourne and Beachy Head or to the works of Messrs. Allen West & Co., Ltd. In the evening there will be an informal dinner and a reception by the Mayor and members of the Brighton Corporation, followed by a dance and cabaret at the Royal Pavilion.

E.A.W. Conference at Hull

The annual conference of the Yorkshire County Organisation of the Electrical Association for Women was held last Saturday at Hull. Delegates were received at the Corporation Electricity Department's showrooms by Lady Watson (president), who was accompanied by Mrs. B. Waite (chairman, Hull and East Riding Branch). Speaking on "Domestic Supply Costs and Tariffs," Mr. D. Bellamy (deputy commercial manager, Hull Electricity Department) stated that variation in tariffs was inevitable on account of the varying conditions in different parts of the country. Electricity charges had to be regulated in accordance with the cost of supply. The time was coming when the supply of electricity would be almost equivalent to a social service, and care must be taken that one class of consumer was not subsidised at the expense of others. Between 60 and 70 per cent. of the 12,000 electric cookers installed in Hull were in working-class houses, and the undertaking now supplied 200 million kWh of electricity per annum. Miss Caroline Haslett (director, E.A.W.) declared that Hull had nearly twice as many cookers installed as the whole of Belgium. England was up to date electrically, particularly where domestic supplies were concerned, but a simplification of tariffs was necessary. Other speakers were Mrs. Maxwell-Telling (Leeds), Alderman F. Holmes (chairman, Corporation Electricity Committee), and Mr. J. C. Townsley (Sheriff).

Centralised Control of Networks

The paper read by Mr. B. H. Leeson before the last International Conference on Large High-tension Electric Systems has been reprinted and is now available in pamphlet form (Messrs. A. Reyrolle and Co., Ltd.). Its subject is the centralised co-ordination of manual, automatic, and remote control of generating stations, distributing networks and consumers' circuits. The paper includes descriptions of recent developments in unit protective systems, with particular reference to high-speed fault isolation, and schemes of co-ordinated control, a concrete illustration being taken in the South-East England Regional Area of the grid.

I.E.E. Summer Meeting

It is announced officially that sufficient entries have been received to justify the summer meeting of the Institution of Electrical Engineers being definitely arranged to take place in Scotland from June 15th to 20th. Members wishing to participate should return their entry forms as soon as possible, though, in emergency, entries can be accepted up to the middle of May.

Appointments Vacant

Civilian technical officer, assistant II and assistant III in the Admiralty Technical Pool.

Junior assistant engineer for Basingstoke Electricity Department.

Sub-station attendant for Colchester Electricity Department.

Instructor and assistant instructor for metal work at the South-East Essex Technical College, Dagenham.

Assistant master in electrical engineering at Dartford Technical College.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

TUCKER & EDGARS lighting fittings.

DE-MAG iron.

HANDIFREEZE ice-cream freezer.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. C. G. F. Pritchett, A.M.I.E.E., has been elected a director of Pritchett & Gold and E.P.S. Co., Ltd. (which incorporates Peto & Radford and the Premier Accumulator Co.). Mr. Pritchett, who is the elder son of the late Mr. G. E. B. Pritchett, founder of the company, took up the position of works manager in 1928. Consequent upon this new appointment, **Mr. E. Honey,** who now holds the position of production manager, has been appointed works manager.

Mr. C. G. F. Pritchett

Sir Frank Smith, the secretary of the Department of Scientific and Industrial Research, is to hold the office of Director of the National Physical Laboratory, pending the appointment of a successor to the late Sir Joseph Petavel.

Mr. A. M. Estcourt has been appointed secretary and treasurer of the Glasgow Corporation Electricity Department in succession to the late Mr. John Simpson. Mr. Estcourt has been associated with the Department for thirty years, and is at present chief clerk. The salary attached to the position is £750, rising to £1,000.

Mr. R. F. Mathieson, whose appointment as sales engineer in the Midlands area for the E.M.B. Co., Ltd., was recorded in our last issue, will have his headquarters at the company's head office, Moor Street, West Bromwich, not Birmingham, as stated.

Mr. W. H. Sharpe has been appointed assistant mains engineer to the Stafford Corporation at a commencing salary of £350 per annum, rising to £375.

Mr. J. S. Selley, sales engineer of Venner Time Switches, Ltd., was married on April 18th to Miss Hilda Polden, younger daughter of Mr. and Mrs. Francis C. Polden.

South Africa will be officially represented at the Third World Power Conference to be held at Washington in September. The Union delegates will probably be **Dr. H. J. van der Bijl,** chairman of the Electricity Supply Commission, who is also chairman of the South African National Committee of the World Power Conference; and **Dr. B. Price,** general manager of the Victoria Falls and Transvaal Power Co., Ltd. Papers will be presented on the fuel resources of South Africa, and on the compilation and international comparison of power statistics.

Mr. E. B. Holloway, the hon. secretary of the Electrical Section of the Ironmongers' Federated Association, has been elected president of the Birmingham and Midland Ironmongers' Association.

Mr. W. F. Jarvis, the author of the article on "Showroom Window Display" published in our last issue was inadvertently styled "F. Jarvis." Mr. Jarvis is showroom sales superintendent in the Bury Corporation Electricity Department.

Mr. J. H. Silley, O.B.E., past president of the Institute of Marine Engineers, was to be presented with a portrait of himself at a special meeting of the Institute on April 22nd. The presentation was to be made by Mr. G. Adams, vice-president, on behalf of the Council. Mr. Silley has been a member of the Institute for over forty years.

In order to avoid any confusion which may have arisen in connection with the appointments held by certain officials of the North-Eastern Electric Supply Co., Ltd., the company asks us to state that the heads of the undermentioned departments are as follows:—Mines Department and Change of Frequency Department, **Mr. S. Burns,** M.I.E.E., M.I.Min.E.; Construction Department (Electrical Section), **Mr. N. Cresswell,** A.M.I.E.E.; and Operation Department (Transmission and Distribution), **Mr. P. C. Parker,** B.S.c.

Mr. A. D. Webber, a director of the Provincial Incandescent Fittings Co., Ltd., is a passenger on the s.s. *Berengaria* on his way to the United States, where he will introduce "Pifco" products in the leading cities. He will be away for some months.

Mr. G. E. Pike, formerly with the South Wales Electric Power Co., has been appointed to the position of senior draughtsman with the Eastbourne Corporation Electricity Department.

Mr. H. C. Johnson, who was formerly with the Rugby Corporation Electricity Department, has been appointed showroom assistant with the Eastbourne Corporation Electricity Department.

Col. H. Carter, T.D., B.Sc., A.R.C.Sc., M.I.E.E., who, as we learn from the *Post Office Electrical Engineers' Journal,* was recently appointed staff engineer, External Plant and Protection Branch, G.P.O., attended a number of important International Conferences of the C.C.I. and C.M.I. held at Paris, Prague, and in Switzerland and Germany. He has also served on committees of the British Standards Institution. He became executive engineer in 1928 and assistant superintending engineer in 1933. Before the War he served in the London University O.T.C. (Artillery), and East Kent Yeomanry, and was in the Royal Engineer Signals from 1914 to 1921. He saw service in France and was officer-in-charge of a Telegraph Construction Company, being mentioned in dispatches. He is also interested in air defence, and from 1929 to 1934, commanded the London Air Defences Signals Company.

Our contemporary also mentions the appointment of **Mr. F. E. Nancarrow,** M.I.E.E., as staff engineer in the Telegraph Branch, G.P.O., and of **Mr. A. Speight,** M.I.E.E., as head of the Engineer-in-Chief's Organisation and Efficiency Branch.

Mr. F. Hodgkinson, consulting mechanical engineer, Westinghouse Electric and Manufacturing Co., South Philadelphia, who has recently retired, was born in London, England, in 1867, and attended the Royal Naval School, New Cross, afterwards serving an apprenticeship with Messrs. Clayton and Shuttleworth, agricultural engineers, Lincoln. According to *Electrical Engineering,* the official organ of the American I.E.E., Mr. Hodgkinson was in 1885 associated with the Hon. (later Sir) C. A. Parsons in the early development of the reaction steam turbine. In 1890 he joined the Chilean Navy, and at the end of the Civil War he held positions in Peru as assistant engineer at an electric lighting station and installation engineer for a mining company. In 1894 he joined Messrs. C. A. Parsons & Co., Newcastle-on-Tyne, as superintendent of construction and, in 1896, when the late Mr. G. Westinghouse negotiated a licence agreement with Messrs. Parsons, he became associated with the Westinghouse Machine Co. He was in charge of steam turbine construction until 1916, when he was appointed chief engineer of the Westinghouse Electric & Manufacturing Co., becoming consulting engineer in 1926. He served on the American I.E.E. Power Generation Committee (1924-1928).

Mr. P. G. Hobbs, who, during the past eight years has been prominently connected with the progress of the Weald Electricity Supply Co., Ltd., in the rural districts of Kent, and who was previously electrical manager of the Crowborough (Sussex) District Gas and Electricity Co., has been appointed managing engineer to the Folkestone Electricity Supply Co., Ltd., a subsidiary undertaking (as is the Weald Co.) of the County of London Electric Supply Co., Ltd.

Mr. P. G. Hobbs

Mr. S. B. Haslam has been nominated branch president of the South Wales Branch of the Association of Mining Electrical Engineers for the session 1936-37.

Mr. T. A. Littlewood has been appointed sales engineer to the Midland Electric Installation Co., Ltd., in connection with the company's Midland Agency for Messrs. Erskine Heap's switchgear.

Obituary

Mr. H. R. Wilson.—The death occurred on April 19th, at the age of seventy-three, of Mr. Henry Raynor Wilson, an authority on railway signalling and the author of a number of works on the subject.

Brig.-General A. H. Leggett, died at his home at Ashstead on April 16th, at the age of fifty-eight. He had been working at his office at the Federation of British Industries, where he had been head of the organisation department since 1920, up to the day before his death.

Mr. C. Sandys-Ball, A.M.I.E.E., A.M.I.M.E., of Kersbrook, Claygate, whose death occurred on April 14th, was until his retirement in practice as a consulting engineer.

Will.—Major G. Jacques, M.I.E.E., secretary of the Western Electric Co., Ltd., left £21,620, with net personalty £20,761.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

P. T. Finance Trust, Ltd.—Private company. Registered April 15th. Nominal capital, £50,000 in £1 shares (5,000 "A" and 45,000 "B"). Objects: To adopt an agreement with Le Conducteur Electrique Blinde Incombustible and Société Alsacienne de Constructions Mécaniques, to acquire patents, &c., to manufacture and deal in machinery; to carry on the business of electrical engineers and contractors, electricians, mechanical engineers and manufacturers of telephones, telegraphs (wireless or otherwise), phonographs, accumulators and lamps; to acquire and hold shares, stock, debentures or other securities, &c. The first directors are: Sir Brograve C. Beauchamp, Bt., 26, Charles Street, Berkeley Square, W.1; G. W. Duncan, 3, Buckingham Gate, S.W.1; and one other to be appointed. Registered office: 74, Victoria Street, S.W.1.

Frank Brown (Heanor), Ltd.—Private company. Registered April 9th. Capital, £1,500. Objects: To acquire the business of a wireless and electrical dealer carried on by F. L. Brown at 28, Westfield Avenue, Marlpool, Heanor. The directors are: F. L. Brown and Mrs. I. Brown, both of 28, Westfield Avenue, Marlpool, Heanor.

Ciecolectric Vehicles, Ltd.—Private company. Registered April 6th. Capital, £1,500. Objects: To carry on the business of manufacturers and factors of and dealers in electrical equipment, vehicles, accumulators, dynamos, &c. The permanent directors are: R. Markham, 36, Wynfield Road, Leicester, and G. S. Jinks, 88, Barbara Avenue, Leicester. Secretary and registered office: E. S. King, 1B, Halford Street, Leicester.

H. G. Sutherland, Ltd.—Private company. Registered April 9th. Capital, £250. Objects: To carry on the business of manufacturers of and dealers in radio sets, gramophones and sound reproducing instruments, &c. The directors are: H. G. Sutherland, 61, Queen's Road, Battersea, and G. W. E. Sutherland, Victoria House, Knatshill, Woking. Registered office: 47, Queen's Road, Battersea, S.W.8.

Frank Johnson & Co. (Worcester Park), Ltd.—Private company. Registered April 14th. Capital, £600. Objects: To carry on the business of electrical engineers, &c. The directors are: F. Johnson (managing director), 36, St. Phillips Avenue, Worcester Park, Surrey, and three others. Secretary: F. Johnson. Registered office: Dacre House, Victoria Street, S.W.1.

G. H. Mackey (Electricians), Ltd.—Private company. Registered April 14th. Capital, £200. Objects: To carry on the business of electrical engineers and general electrical installation contractors, &c. The subscribers are: G. H. Mackey, 9, Leonard Avenue, Sherwood, Nottingham, and C. J. White, Prudential Buildings, Queen Street, Nottingham.

Nelson Electricity Corporation, Ltd.—Private company. Registered April 15th. Nominal capital, £100. Objects: To acquire all the rights and interests in a licence granted to the Hume Pipe Co. (Australia), Ltd., to obstruct the waters of the Cobb River and to use such water for the purpose of generating electricity, and to carry on in New Zealand and elsewhere the business of an electricity supply company in all its branches. The subscribers are: V. Hudson and Doris Tooth, both of 7, Stone Buildings, Lincoln's Inn, W.C.2. Solicitor: P. W. Bullock, 7, Stone Buildings, Lincoln's Inn, W.C.2.

Improved Submerged Log Co., Ltd.—Private company. Registered April 9th. Capital, £10,000. Objects: To carry on the business of manufacturers and repairers of and dealers in nautical and all other instruments, dynamos, motors, armatures, magnetos, batteries, conductors, transformers and general electric plant, machinery, &c. The subscribers are: W. E. Jardine, 16, St. James Square, S.W.1, and three others. F. Ward, 100, Holland Road, W.14, signs as director. Registered office: Parliament Mansions, Church Street, Victoria Street, Westminster, S.W.1.

I. C. B. Sign & Engineering Co., Ltd.—Private company. Registered April 16th. Capital, £100 in £1 shares. Objects: To carry on business as general, mechanical and electrical engineers, founders, metal smiths and workers, manufacturers of and dealers in engineering, mechanical and electrical goods and appliances, &c. The subscribers are: G. Parnell, 67, Fenwick Road, Peckham, S.E.15; and D. H Goddard, 82, Hatchard Road, Upper Holloway, N.19. Secretary: D. H. Goddard. Registered office: 5, Forum Way, Edgware.

Dewsbury Relay Service, Ltd.—Private company. Registered April 16th. Capital, £4,000 in £1 shares. Objects: To apply for and obtain licences for the reception and distribution of wireless or television signals, &c. The directors are: J. A. Parish (permanent managing director), 38, Sherburn Terrace, Consett, Co. Durham; and J. C. Robinson, Pontop House, Dipton, Newcastle-on-Tyne. Secretary: W. F. Reed, Town Hall Chambers, Consett, Co. Durham.

Vaughan Martin, Ltd.—Private company. Registered April 17th. Capital, £2,000. Objects: To carry on the business of wholesale and retail electrical factors and merchants, motor and electrical engineers, &c. The first directors are F. Martin (permanent governing director) and L. E. Martin. Registered office: 16, Kingston Hill, Kingston, Surrey.

Electrical Calculators, Ltd.—Private company. Registered April 17th. Capital, £500. Objects: To carry on business as electrical and mechanical engineers, manufacturers and vendors of scientific instruments and apparatus, &c. The directors are: C. L. Blackburn, 37, Knightsbridge, London, S.W.1, and E. H. Smythe, "Beaufort," Gipsy Lane, S.W.15. Secretary: I. A. Price, 15, Heath Drive, S.W.20. Registered office: 34, Victoria Street, S.W.1.

Returns of Electrical Companies

W. H. Allen, Sons, & Co., Ltd.—Satisfaction in full on or before March 28th, 1936, of charge dated June 21st, 1926, and registered July 9th, 1926. (According to the register of mortgages, the only charge registered July 9th, 1926, was a mortgage which originally secured an unascertained amount of excess profits duty, interest, income tax and corporation profits tax.)

British Crystal Lamp Co., Ltd (Formerly British Crystalite Co., Ltd.).—G. S. Rate, "Glenelly," Ardleigh Green Road, Hornchurch, ceased to act as receiver and manager on April 4th, 1936.

Automatic Electrical & Mechanical Controls, Ltd.—Issue on March 30th, 1936, of £100 debentures, part of a series already registered.

"New Era" Time & Telephone Systems, Ltd.—Particulars filed of debentures to secure £30,000 (including £20,000 already registered) and bonus of 5 per cent. authorised February 14th, 1936, and covered by trust deed dated March 16th, 1936, charged on contracts and rents and sums due and to become due and owing thereunder and the company's undertaking and other property, present and future, including uncalled capital, the amount of the present issue being £10,000. Trustees: J. P. Parish and J. Toole.

British Relay Wireless, Ltd.—The nominal capital has been increased by the addition of £500 in £1 ordinary shares beyond the registered capital of £5,000. The additional capital is divided into 500 ordinary shares of £1. This increase is for the purpose of acquiring the undertaking and assets of English Relay Wireless, Ltd.

Aldeburgh Electric Supply Co., Ltd.—The nominal capital has been increased by the addition of £6,000 in £1 ordinary shares beyond the registered capital of £12,000.

Lotus Radio (1933), Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1936. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Sowerby Bridge Relay Services, Ltd.—Capital, £3,000 in 1,000 preference and 2,000 ordinary shares of £1 each. Return dated February 20th, 1936. 750 preference and 1,003 ordinary shares taken up. £1,253 paid on 750 preference and 503 ordinary shares, £500 considered as paid on 500 ordinary shares. Mortgages and charges: £212 11s. 10d.

Double Filaments, Ltd.—Capital, £250 in £1 shares. Return dated January 14th, 1936. 250 shares taken up. £250 paid. Mortgages and charges, nil.

London School of Electrical Domestic Science, Ltd.—Capital, £100 in £1 shares. Return dated January 31st, 1936. All shares taken up. £100 paid. Mortgages and charges, nil.

Alder Electrical Appliances, Ltd.—Capital, £750 in £1 shares. Return dated February 3rd, 1936. 575 shares taken up. £575 paid. Mortgages and charges, nil.

Lamp Manufacturing & Railway Supplies, Ltd.—Capital, £9,000 in 5,500 preference and 3,500 ordinary shares of £1. Return dated December 16th, 1935. 4,500 preference and 3,003 ordinary shares taken up. £4,503 paid, £3,000 considered as paid. Mortgages and charges, nil.

Power Centre Co., Ltd.—The nominal capital has been increased by the addition of £1,500 in £1 ordinary shares beyond the registered capital of £1,500.

Singapore Traction Co., Ltd.—The nominal capital has been increased by the addition of £25,000 beyond the registered capital of £550,000. The additional capital is divided into 25,000 7 per cent. cumulative preference shares of £1. These shares have since been converted into preference stock.

British Central Electrical Co., Ltd.—Debenture dated March 27th, 1936, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Satisfaction to the extent of £800 (amount issued), on March 17th, 1936, of debentures authorised July 20th, 1931, and registered July 31st, 1931, and March 9th, 1936, securing not more than £1,000. (£200 unissued debentures have been cancelled.)

Wartburg Lamps, Ltd.—Satisfaction in full on March 18th, 1936, of debentures authorised February 9th, 1933, and registered February 13th, 1933, securing £650.

Fagins, Ltd.—R. M. Fowler, of 10, Station Parade, Balham, S.W.12, ceased to act as receiver and/or manager on February 27th, 1936.

Camel Accumulators, Ltd.—Capital, £300 in £1 shares. Return dated December 31st, 1935. 300 shares taken up. £300 paid. Mortgages and charges, nil.

S.E.P., Ltd.—Capital, £100 in £1 shares. Return dated December 1st, 1935 (filed March 26th, 1936). 54 shares taken up. £54 paid. Mortgages and charges, nil.

W. D. Radio Co., Ltd.—Capital, £1,000 in £1 shares (increased from £500 on January 6th, 1936). Return dated December 31st, 1935 (filed March 5th, 1936). Two shares taken up. £2 paid. Mortgages and charges, nil. A further 998 shares were allotted as fully paid on February 20th, 1936.

Medway Relay Service, Ltd.—Capital, £12,000 in 10,000 preference shares of £1 and 40,000 ordinary shares of 1s. Return dated January 7th, 1936. 6,230 preference and 26,950 ordinary shares taken up. £7,577 10s. paid. Mortgages and charges, £957 18s. 9d. (bank overdraft).

City Notes

Strand Electric Holdings, Ltd.—The statutory meeting of this company was held on April 17th when Mr. F. L. Blow, who presided, said that the operating company, the Strand Electric & Engineering Co., Ltd., had been entrusted with the work of installation of stage equipment for the *Queen Mary* and had also secured the contract for the wiring, switchboards, and other equipment for the lighting of the new television studios of the B.B.C. at Alexandra Palace. A considerable amount of work had also been carried out from time to time for H.M. Office of Works and the Department of Overseas Trade, for whom an order was at present in hand for the Empire Exhibition being held this year at Johannesburg. At the present time the work in hand and recent contracts included the Playhouse, Dundee, one of the largest cinemas in Great Britain, and numerous other theatres and cinemas, as well as extensions to Covent Garden Opera House and the Shakespeare Memorial Theatre, Stratford-on-Avon. Other contracts included work on flats in Grosvenor Square and other important buildings and factories in various parts of the country. They expected a busy time in connection with the forthcoming Coronation.

The Marconi International Marine Communication Co., Ltd.—Presiding at the annual meeting held on April 17th, Mr. J. C. Denison-Pender (chairman) said that, in 1933, the average number of ships out of commission in which their company was interested was 22½ per cent. For 1934 the figures had fallen to 12½ per cent., while for 1935 the average number was 10.63 per cent. Whereas in 1933 the total number of craft of 1,600 tons and over launched from British yards for British owners was twenty-two, in 1934 it was fifty-four, and in 1935 the total number of similar craft was sixty-two. They continued to obtain the major part of all business available, both on compulsorily fitted ships and on the smaller types of craft, such as trawlers and coastal ships, and in spite of increasing competition in 1935, they secured 79.5 per cent. of all the available wireless business. The administrative reorganisation was now complete. The Marconi Sounding Device Co., Ltd., was still increasing its turnover.

The Rangoon Electric Tramway & Supply Co., Ltd., reports a gross profit for 1935 of £181,764, and after deducting debenture interest, &c., and placing £57,000 to renewals account and £20,171 to contingencies reserve, there is a net profit of £70,046. To this is added £24,077 brought in, making £94,123 available. It is proposed to pay a final dividend of Rs.1-2-0 per share, free of Indian tax, making 10 per cent. for the year (against 8¼ per cent.), and to carry forward £24,123. The report states that £100,000 5 per cent. debenture stock was redeemed at £105 per £100 stock in February, 1935. The amount of 5 per cent. debenture stock outstanding at December 31st last was £200,000. A new 10,000-kW turbine was purchased and its erection was in hand at the close of the year. The company's vehicles travelled 7,659,852 miles and carried 44,617,512 passengers during the year. Application has been made for a new Tramways Order (to include the operation of trolley buses) to replace the existing Rangoon Tramways Order, 1924.

Babcock & Wilcox, Ltd., report a profit for 1935 of £501,495, as compared with £424,762 in the preceding year, from which is deducted contribution to staff pension funds (£21,083), and after adding £44,406 brought in, there is a total of £524,818 available. The final ordinary dividend is 4 per cent., maintaining the distribution for the year at 8 per cent., and £100,000 is placed to the dividend equalisation fund (increasing this fund to £300,000). The balance carried forward is £65,893. The report states that while trading conditions in the home market continue to be encouraging, it is necessary to strike a note of caution in view of the international situation and the restrictions which exist on international trading, due to exchanges and the economic conditions prevailing in many countries. A large proportion of the business of the company is export. Considerable additions have been made during the year in the shape of modern equipment. Meeting: May 4th.

Bruce Peebles & Co. report a net profit for 1935 of £1,261, as compared with £5,309 in the preceding year, to which is added £793 brought in. The directors do not recommend any dividend for the past year on either the preference or ordinary shares, and £2,054 is carried forward. Preference dividends are in arrears from March 31st, 1930. The report states that the past year's results compare unfavourably with the previous year's due to a smaller turnover and also to the increased volume of orders uncompleted at the end of the year. The benefit of this increase will accrue during the current year. During the latter part of the year the company obtained a further substantial contract for mercury-arc rectifiers from the Southern Railway for the extension of its electrification system, the whole of which will be completed during 1936. With the volume of orders now in hand it is anticipated that the turnover for the current year will be considerably increased.

The Telephone Manufacturing Co., Ltd., proposes to pay a final dividend of 5 per cent., making 7½ per cent. for the year (against 2½ per cent.). The directors propose to seek authority to increase the authorised capital.

The Bath Electric Tramways, Ltd., held its annual meeting on April 16th. Mr. E. H. R. Trenow (chairman), who presided, in the course of his speech, said that taking the revenue account for the year 1935, modified fares were in operation for nine months of the year. It was not therefore surprising that the traffic and other receipts showed a decrease of £2,303. The number of passengers carried increased by nearly 7½ per cent. The full effect of the revision of the fares brought about by the termination of the Temporary Increases of Charges Act had yet to be ascertained. While travel for business purposes had been maintained, travel for pleasure had been definitely curtailed by the unsatisfactory weather conditions of the winter months.

The Metropolitan Electric Cable & Construction Co., Ltd., reports a net profit for 1935 of £19,114, as compared with £12,888 in the preceding year, which with £1,066 brought in makes £20,180. After deducting income tax, preference dividend and placing £6,000 to preference share reserve, it is proposed to pay an ordinary dividend of 5 per cent. (against 3½ per cent.), and to carry forward £1,344. Meeting: April 23rd.

Cable and Wireless (Holding) Ltd., reports that the figures for 1935 show a profit which is sufficient to enable the directors to recommend the payment of a total dividend of 5½ per cent., less tax, on the preference stock, being a final payment of 4⅛ per cent. in respect of the year 1933 and 1⅜ per cent. in respect of the year 1934. The general meeting will be held on May 22nd.

G. D. Peters & Co., Ltd., report a profit for 1935, after charging all expenses except depreciation, of £2,162, which has been transferred to reorganisation account.

The Adelaide Electric Supply Co., Ltd., has announced an interim dividend of 5 per cent. on the ordinary stock (against 5 per cent., plus a capital bonus of 25 per cent.).

Allen West & Co. report a net profit of £8,295 for the year ended January 31st last, after placing £25,000 to depreciation reserve.

Marconi's Wireless Telegraph Co., Ltd., proposes to pay a dividend of 4½ per cent., less tax, on the ordinary shares for 1935 (against 6 per cent. for 1934).

The City of Buenos Aires Tramways Co. (1904), Ltd., is paying a quarterly dividend of 1¼ per cent. (same).

The Telegraph Condenser Co. is maintaining the ordinary dividend for 1935 at 20 per cent.

Herbert Morris, Ltd., have declared an interim ordinary dividend of 5 per cent., tax free (against 5 per cent., less tax).

Murex, Ltd., has announced an interim ordinary dividend of 10 per cent. (same).

Stocks and Shares

Tuesday Evening.

THE addition to the Income Tax proposed in the Budget that was opened by the Chancellor of the Exchequer this Tuesday afternoon was quite unexpected in Stock Exchange circles, and according to discussions that went on by telephone after hours it is not likely to bring much immediate market advantage in its train. The general Stock Exchange theory is that extra taxation spells contraction of business in stocks and shares. If this should prove to hold good on the present occasion, gilt-edged securities will probably give way to some extent, and the markets will go softly for a time, pending the digestion of this unpalatable proposal.

Up to the time of the Chancellor's delivery of his speech, markets had viewed the Budget outlook with an indifference which amounted to apathy. It may be said to have had no effect in advance upon prices. Consequently, the unlooked-for increase in the Income Tax will be the more sharply reflected, at all events for a time. Nevertheless, all past experience has shown that both investment and speculation are extremely adaptable in the matter of accepting what burdens are laid upon them.

The Cable and Wireless Dividend

The declaration by the Cable and Wireless combine of a 5½ per cent. dividend in respect of the preference capital was followed by a sharp rise in the price of the stock. After jumping to 114½, the quotation is now 109 ex dividend. The net gain on the week is 2½ points. General approval of this increase of 1⅜ per cent. over the previous distribution is self-evident. Dividend arrears have now been made good for the whole of 1933 and for the first quarter of 1934. The question of how the balance of arrears is to be dealt with remains unsolved; probably the eagerly awaited scheme will be propounded when the report and accounts are made public in the middle of next month. Making allowance for last year's repayment of some £6,500,000 of preference stock, approximately £1,600,000 would be required to pay the 9⅜ per cent. dividend arrears outstanding at the end of 1935. Some sort of funding scheme for the arrears seems to be indicated. It is unlikely that the combine will undertake the slow process of making up the lost ground out of profits. It is worth noting that, after deduction from the price of the equivalent of the dividend arrears outstanding, the preference stock would provide a yield in the region of 5½ per cent. The traffic index figure for March is again satisfactory.

The Cable and Wireless combine has a controlling interest in Marconi's Wireless Telegraph Co. The reduction of the latter company's dividend distribution from 6 per cent. to 4½ per cent. is disappointing to Cable and Wireless stockholders.

Electricity Supply Shares

The report of an 18 per cent. increase in the amount of electricity generated in this country during the first quarter of the year, as compared with the corresponding quarter of 1935, failed to dispel the lethargy which has fallen upon the market in the supply companies' shares. Prices are keeping up well, but, as our list shows, movements are few and unimportant. A quiet demand for North Easterns moved the price up 1s. to 34s. 6d. Electric Supply Corporations rose ⅛ to 67s., with the result that the quotation remains unaltered at 65s. 9d. after deduction of the dividend. Bournemouth and Poole and Scottish Power each put on 6d., and Llanellys improved to 25s. 6d. British Power and Light at 32s., and Newcastles at 36s. 3d., are a shade easier. Elsewhere, Calcuttas and Tokyo "sixes"

made small advances to 62s. 6d. and 83 respectively. Palestine "A" shares fell 1s. to 51s. 6d. on news of local unrest. Perak Hydros shaded to 25s. 6d.

Manufacturing and Equipment

After last week's display of strength the electrical equipment market subsided into the quietude which political uncertainties have caused to pervade most sections of the Stock Exchange. The underlying strength of the market is, however, sufficient to prevent the reaction which often accompanies a slackening of activity. Prices appear to have become consolidated at the higher levels reached last week; there are some bright spots among the shares of the smaller equipment companies.

Callenders, which have lately gone ahead on the execution of two unusually heavy buying orders, have lost none of their advance to 4⅜. The absorption of the 3,000 or so Henley's shares which have lately come to market is proceeding without producing any disturbance in the price of 7¼. Enfields and British Insulated hold firmly to their higher levels. Johnson and Phillips, however, are lower at 45s. ex dividend, despite the company's good results. Siemens, at 28s. 9d., have risen 1/8 in anticipation of the dividend statement due shortly.

Lancashire Dynamos are being bought on a growing appreciation of the company's prospects. At 45s. 9d. the shares are a further 2s. 9d. to the good. Three months ago the price was under 30s. Chloride Electrical Storage rose 1/8 to 95s., and Reyrolles 6d. to 68s. 6d. A fresh rise of 6d. to 9s. 3d. in Telephone Manufacturing is due to hopes that a final dividend of 5 or even 7½ per cent. will follow last October's interim payment of 2½ per cent. Telegraph Condensers dropped ¼ to 2¼, the expectation of an improvement over the previous year's 20 per cent. dividend having been disappointed. Strand Electric Holdings improved to 7s. after the statutory meeting, at which the chairman reported expanding business, and spoke of a dividend statement at an early date. Enfield Rolling Mills declined at first from 23s. to 22s., but rebounded to 23s. 6d. Metropolitan Electric Cables announce a tax-free dividend of 5 per cent., against last year's 3½ per cent. The 5½ per cent. preference is quoted 21s. 9d.

Miscellaneous Matters

British Electric Traction deferred rose 25 to 1,625. Tillings gained 1s. 6d. to 71s. on news of the bonus distribution of one new ordinary share for every three held, to be made by the Tilling and British Automobile Traction Company, in which B.E.T.s and Tillings are jointly interested. Slight uneasiness on the score of possible labour difficulties is responsible for a drop of 2 points to 103 in the "C" stock of the London Passenger Transport Board. The Board's other issues are, however, generally higher.

Transatlantic investors are still nervous of the European situation; American electrical and utility stocks as a whole reflect the apprehension. International "Tel. and Tel." shed 1⅛ to 14⅜, Western Unions 3½ to 84½, Hydro Electrics ⅜ to 7⅜, and Radio Corporations 1 to 11⅛ during the week. American "Tel. and Tel." resisted, and, after recovering 2 points to 169½, are finally unaltered at 167½. Canadian Marconis remain at 8s. 6d.

Stock on Offer

British Power and Light Corporation ordinary stock is on offer at 32s. 3d. per £1 unit of stock. The price excludes the last dividend, and also the right to the new shares which were recently offered to shareholders at 25s. The yield on the money works out at £3 14s. 3d. per cent. The North Wales Power Company is the most important subsidiary.

Net profits earned by the British Power and Light Corporation have almost exactly doubled during the last seven years, the rate of increase being materially accelerated during the past two years. The dividend of 6 per cent., for 1935, compares with 3⅜ per cent. paid for nine months in 1934, and 3 per cent. for each of the three previous years. The Corporation's capital includes £1,000,000 6 per cent. preference stock; there are no debentures.

International "Tel. & Tel."

Holders of shares in the International Telephone and Telegraph Company are asking what steps, if any, they should take in view of the Corporation's decision to limit foreign ownership of the shares to 20 per cent. of the issued capital. If the certificates stand in private, British names, the proprietors should undoubtedly transfer the shares to one of the various bodies whose names would be regarded as American; *i.e.*, not "foreign." The cost is trifling, and the new certificates will be readily negotiable. If the shares already stand in British names as well known in New York as they are in London, it may be thought that there is no necessity to take further action at present. Any rights or dividends that might accrue would be claimed from the British firms, and obtained without delay; it is understood that the 20 per cent. of "foreign" ownership is not yet complete. To put the matter beyond possibility of dispute, the shares could be transferred into American names, the owner agreeing to wait for payment if any benefit should be declared by way of dividend or rights. The market in the London Stock Exchange deals indiscriminately in foreign or in American certificates of ownership; no difference is made between the prices of each class.

Share List of Electrical Companies

	Nom.	Dividend. 1933.	Dividend. 1934.	Price April 21.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	77/6	+6d.	3 17 5
City of London	1	7½	7½	37/6	—	4 0 0
Clyde Valley	1	7	8	45/6	—	3 10 4
County of London	1	10½	10½	57/–	—	3 13 8
Edmundson's 7% Pref.	1	7	7	36/–	—	3 17 9
Do. Ord.	1	7	8	45/–	—	3 11 1
Elec. Dis. Yorkshire	1	9	9	47/–	—	3 16 7
Elec. Fin. and Securities	1	12½	12½	3 7/8	—	3 12 9
Elec. Supply Corporation	1	11	11	65/9xd.	+1/8	3 7 0
Lancs Light and Power	1	7½	7½	39/–	—	3 17 0
Lond. Assoc. Electric	1	—	—	34/–	—	4 2 4
London Electric	1	7	8	40/–	—	4 0 0
London Power Deb. Red.	Stock	5	5	107½	—	4 13 0
Metropolitan	1	10	10	52/–	—	3 17 0
Midland Counties	1	7	7½	41/–	—	3 13 2
Mid. Elec. Power	1	8	8	41/3	—	3 17 7
North Eastern Electric Ordinary	1	6	6	34/6	+1/–	3 9 7
Do. 7% Pref.	1	7	7	34/6	—	4 1 2
Northampton	1	10	10	55/–	—	3 12 9
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	3	—	3 6 8
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	42/6	+6d.	3 15 3
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	46/–	—	3 9 7
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	116½	—	4 4 10
Do. 1955–75	,,	5	5	119	—	4 4 0
Do. 1951–73	,,	4½	4½	112	—	4 0 4
Do. 1963–93	,,	—	3½	103	—	3 8 0
London Elec. Trans. Gtd.	,,	—	2½	97	—	2 11 7
London & Home Counties, 1955–75	,,	4½	4½	112	—	4 0 4
London Passenger Transport, A.	,,	—	4½	125½	+1	3 11 9
Do. do. B.	,,	—	5	128	+1	3 18 2
Do. do. C.	,,	3½	4	103	–2	3 17 8
West Midlands Joint Elec. 1948–68	,,	—	5	116½	—	4 5 10
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	167½	—	5 7 6
Anglo-Am. Tel. Pref.	Stock	6	6	123½	—	4 17 2
Do. Def.	,,	1½	1½	29	—	5 3 5
Cable & Wireless 5½% Pref.	,,	4½	5½	109xd.	+2½	5 1 0
Do. A. 7½% Ord.	,,	Nil	Nil	28	—1	—
Do. B. Ord.	,,	Nil	Nil	8	—	—
Globe Tel. & Tel. Ord.	10	2½	3½*	16½	+⅜	2 3 4
Do. do. Pref.	10	6	6	14½	+⅛	4 4 3
Great Northern Tel.	10	20	20	45	—	4 9 0
Marconi-Marine	1	10	7½	33/3xd.	+3d.	4 10 3
Oriental Telephone Ord.	1	12	12	3¼	—	3 13 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1625	+25	—
Do. do. Pref. Ord.	,,	8	8	179½	—	4 19 2
Brazil Traction	100	—	—	12¼	–¼	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	100½	—	4 19 6
Mexican Light Common	100	Nil	Nil	4½	—	—
Do. 7% Pref.	100	7	7	6½	—	—
Do. 1st Bonds	$500	5	5	50	–7½	—
Victoria Falls Ord.	1	20	20	78/–	+6d.	—
West Riding	1	5	6½	52/6	—	2 9 6
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	67/6	+1/8	4 9 0
Assoc. Elec. Ord.	1	6	8	47/6	—	3 7 4
Do. Pref.	1	8	8	39/–	—	4 2 1
Babcock & Wilcox	1	6	8	52/6xd.	+6d.	3 1 0
British Aluminium Ord.	1	5	7½	41/0	—	3 13 2
British Insulated Ord.	1	15	20	5¼	—	3 16 1
Brush Ord.	Stock	Nil	Nil	39½	–3	—
Callender's	1	15	15	4⅜	—	3 8 2
Do. 6½% Pref.	1	6½	6½	32/6	+1/8	4 0 0
Crompton Parkinson Ord.	5/–	—	12½	65/–	—	0 19 3
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref.	1	7½	7½	30/–	—	5 0 0
Electric Construction	1	Nil	3½	1⅞	—	1 17 4
Enfield Cable Ord.	1	25	25	5⅜	—	4 13 0
English Electric	1	Nil	Nil	21/–	+6d.	—
Do. do. Pref.	1	Nil	Nil	26/–	—	—
Ericsson Tel.	5/–	24	20*	2¼	—	2 4 6
Ever Ready	5/–	35	35	24/9	—	7 1 5
Ferranti Pref.	1	7	7	26/9	—	5 4 8
G.E.C. Pref.	1	6½	6½	34/–	—	3 16 6
Do. Ord.	1	8	10	79/6	—	2 10 4
Henleys	1	30	30	7½	—	4 2 9
Do. 4½% Pref.	5	4½	4½	5⅜	—	3 18 3
India-Rubber Preferred	1	—	5½	1¼	—	4 17 9
Johnson & Phillips	1	7½	10	45/–xd.	—1/–	4 9 0
Siemens Ord.	1	6½	4	28/9	+1/8	2 15 8
Telegraph Construction	£1	Nil	Nil	27/6	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1934

3446. "High-frequency inductance coils." W. J. Polydoroff. March 4th, 1935. (444564.)

18419. "Electric incandescent lamps." Soc. Anon. pour les Applications de l'Electricité et des Gaz Rares Etablissements Claude-Paz & Silva. January 23rd, 1934. (444566.)

18624. "Thermionic valves." Marconi's Wireless Telegraph Co., Ltd. June 24th, 1933. (444567.)

20798. "Spinning-machine drives comprising commutator motors regulated by brush shifting." Siemens Schuckertwerke Akt.-Ges. July 15th, 1933. (444624.)

22027. "Electrical circuits and apparatus, including grid-controlled gaseous-discharge tubes." J. W. Dalton. July 27th, 1934. (444810.)

24551. "Synchronous-motor electric clocks." S. Gold. August 25th, 1934. (444688.)

27278. "Ships' telephones." R. R. Glen. September 22nd, 1934. (444590.)

27286. "Vibratory electric motors." R. Goldschmidt. September 22nd, 1934. (444592.)

27324. "Electrode arrangements for Braun tubes." Radio Akt.-Ges. D. S. Loewe and B. Wienecke. September 23rd, 1933. (444633.)

27394. "Tanks for electrical apparatus immersed in cooling liquid." English Electric Co., Ltd., A. T. Chadwick and G. F. Stearn. September 24th, 1934. (444594.)

27466. "Electric cables." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. September 25th, 1934. (444640.)

27492. "Variable band-coupling device for superheterodyne radio receivers." Coutts & Co. and F. Johnson (legal representatives of J. Y. Johnson, decd.) (Philadelphia Storage Battery Co.). September 25th, 1934. (444760.)

27495. "Vibration dampers for electric transmission lines." Aluminium, Ltd. October 6th, 1933. (444694.)

27526. "Electromagnetic switching devices." Automatic Electric Co., Ltd., C. R. Woodland and C. Rhodes. September 25th, 1934. (444698.)

27623. "Electrical signalling systems employing speech or voice current signals." L. E. Ryall. September 26th, 1934. (444598.)

27687. "Dynamo-electric machines." Westinghouse Electric & Manufacturing Co. November 11th, 1933. (444816.)

27872. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. September 28th, 1933. (444642.)

28065. "Excitation of electric generators." British Thomson-Houston Co., Ltd., and C. Stewart. October 1st, 1934. (444822.)

28547. "Drum-wound armatures of dynamo-electric machines." J. Zetsche and Supra Electra Motors, Ltd. October 5th, 1934. (444644.)

29005. "Apparatus for use in binding insulated electrical conductors, insulating bare conductors, or binding together other bodies." P. F. Hellermann. October 10th, 1934. (Addition to 247147.) (444825.)

29434. "Electric light fittings." G. Ellison, Ltd., and J. Anderson. October 15th, 1934. (444648.)

29444. "Wireless receiving systems." British Tungsram Radio Works, Ltd., and J. A. Szabadi. October 15th, 1934. (444826.)

29870. "Sound distributing and amplifying device." M. Weil. October 18th, 1933. (444708.)

30128. "Apparatus for the electrolytic decomposition of water." Siemens & Halske Akt.-Ges. October 24th, 1933. (444709.)

32303. "Safety switches for automobile vehicles." G. Soulat. November 9th, 1933. (444655.)

33067. "Trunk communication electric cables." Siemens & Halske Akt.-Ges. November 16th, 1933. (444830.)

33758. "Electrical indicating systems and relay apparatus for use therein." Cogent Signals, Ltd., and C. Remington. November 23rd, 1934. (444832.)

34245. "Apparatus for the electrical precipitation of suspended particles from gaseous fluids." Lodge Cottrell, Ltd. (Research Corporation of New York). November 28th, 1934. (444660.)

37113. "Alternating current electric drives." T. Broadbent & Sons, Ltd., and W. Hallitt. December 28th, 1934. (444662.)

37261. "Quick-action electric switches." R. T. Waite. December 29th, 1934. (444664.)

37410. "Stems for sealing conductors within electron-discharge and other sealed-envelope devices, and other machines for making the same." Marconi's Wireless Telegraph Co., Ltd. December 29th, 1933. (444714.)

1935

1823. "Electrical fuses." H. G. Baggs. January 19th, 1935. (444666.)

2289. "High-frequency coupling coils." Hazeltine Corporation." February 27th, 1934. (444608.)

2679. "Electrical conductors with air-space insulation." Norddeutsche-Seekabelwerke Akt.-Ges. February 20th, 1934. (Cognate application 2680/35.) (444668.)

4126. "Methods for intelligence transference by radio." L. R. Merdler and Baird Television, Ltd. February 8th, 1935. (444774.)

4627. "Cathode-ray tubes." F. J. G. Van Den Bosch. February 13th, 1935. (444775.)

5758. "Storage photo-electric devices." General Electric Co., Ltd., and B. P. Dudding. February 22nd, 1935. (444843.)

6398. "Thermionic valves." Telefunken Ges. für Drahtlose Telegraphie. March 1st, 1934. (444844.)

6666. "Construction and control of electric heaters." H. Reynolds. March 4th, 1935. (444671.)

7930. "Electric pocket lamps." Metallwerke A. Hopf Akt.-Ges. March 14th, 1934. (444716.)

8388. "Sensitive electric relay devices." Western Electrical Instrument Corporation. July 11, 1934. (444777.)

9337. "Electric water-heating apparatus." M. Nathan and S. G. Gardner. May 9th, 1935. (444686.)

9571. "Navigation-aiding light and radio-energy transmitting arrangements." Marconi's Wireless Telegraph Co., Ltd. (Telefunken Ges. für Drahtlose Telegraphie). March 27th, 1935. (444850.)

12219. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. April 23rd, 1934. (444854.)

12296. "Quick make-and-break electric switches." W. Sanders & Co. (Wednesbury), Ltd., and R. T. Waite. April 24th, 1935. (444855.)

12884. "High-tension electric cables." British Thomson-Houston Co., Ltd. May 1st, 1934. (444856.)

15933. "Electric communication cables." Standard Telephones & Cables, Ltd., and A. G. Smith. May 31st, 1935. (444858.)

16588. "Adjusting and indicating means for electric variable condensers." J. A. Dreyfus. June 8th, 1934. (444780.)

16622. "Methods of applying a top layer to an article, more particularly to the surface of an electric device." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 8th, 1934. (444723.)

18694. "Coin packet shafts for two-coin mechanisms of gas, electricity and like meters." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf. December 6th, 1934. (444783.)

19417. "High-tension electric cables." Soc. Italiana Pirelli. August 6th, 1934. (444730.)

20951. "Magnetic holder and support." M. Baermann, jun., and Dynamit Akt.-Ges. Vorm A. Nobel & Co. July 23rd, 1934. (444786.)

22337. "Electric toasting devices." British Thomson-Houston Co., Ltd. August 8th, 1934. (444736.)

22338. "Thermionic electron emissive electrodes for gas or vapour electric-discharge devices." British Thomson-Houston Co., Ltd. August 10th, 1934. (444737.)

23278. "Röntgen-ray apparatus." Siemens & Halske Akt.-Ges. October 19th, 1934. (444788.)

24001. "Electrically heated rugs." British Thomson-Houston Co., Ltd. August 28th, 1934. (444860.)

27459. "Variable electric condensers." C. Lorenz Akt.-Ges. October 6th, 1934. (444798.)

27855. "Rheostatic braking systems for electric traction motors." Maschinenfabrik Oerlikon. October 20th, 1934. (444613.)

28722. "Resilient mountings for dynamo-electric machines." British Thomson-Houston Co., Ltd. October 19th, 1934. (444799.)

29389. "Arc-welding electrodes." British Thomson-Houston Co., Ltd. October 25th, 1934. (444802.)

29785. "Electrically operated hand-held portable machine tools." J. J. V. Armstrong (R. Bosch Akt.-Ges.). October 29th, 1935. (444676.)

36099. "Electrical signalling systems." Automatic Electric Co., Ltd., C. R. Woodland, and C. Rhodes. September 25th, 1934. (Divided out of 444698.) (444621.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned:—

April 8

Philora. No. 566042. Class 50. Lamp-shades made wholly or principally of cellulose acetate, artificial silk, or mother of pearl.—Philip S. Schulman, Ltd., 76-78, Victoria Road, Rusholme, Manchester.

Versil. No. 565946. Class 50. Articles made wholly or principally of asbestos for electrical, heat and sound insulating purposes, adhesive textile tape impregnated with an electrical insulating medium, electrical, sound or heat insulating substances of asbestos, mica, synthetic resins, oils or bitumen, &c.—Versil, Ltd., Rayner Mills, Liversedge, Yorks.

April 15

Mersikar. No. 565775. Class 4. Activated carbons for use in manufactures.—Mersey Carbons, Ltd., 10, Liverpool Road, Sankey Bridges, Warrington, Lancs.

Aerialite. No. 563179. Class 8. Copper aerials for use in wireless telephony and telegraphy.—Aerialite, Ltd., Junction Mills, Whittington Street, Ashton-under-Lyne, Lancs.

Duralife. No. 567046. Class 8. Electric batteries and accumulators (not for medical purposes).—Camel Accumulators, Ltd., 8, Newington Causeway, S.E.1

Trolitul. No. 566452. Class 50. Moulding powders made of cellulose ethers and esters, or of synthetic resins.—F. A. Hughes & Co., Ltd., Abbey House, Baker Street, N.W.

The E.I.B.A. Cruise

We have now received from the Electrical Industries Benevolent Association a pamphlet giving full particulars of the cruise which the Association is organising in August. As we have already reported, the T.S.S. *Vandyck* has been chartered and she will leave Liverpool on August 22nd for a thirteen-day cruise to Portugal, Morocco and Madeira. The schedule of fares shows the various classes of accommodation available, ranging in price from 16 to 35 guineas. An application form is included and it is noted that intending participants are asked to send this, with 25 per cent. of the fare, to the Executive Officer at 36, Kingsway, W.C.2.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Cinema, High Street and Alfred Road; F. E. Bromidge, architect, 84, Regent Street, London, W.1. Extensions to factory, Landis & Gyr, Ltd., Victoria Road and Chase Road; George Head & Co., architects, 40, Baker Street, London, W.1. Extensions to factory, Meta-phronts, Ltd., Park Road; Percy Pratt & Blount, architects, 174, High Street, W.3. Factory, Wadsworth Road, for British Milanese, Ltd.; R. Seifert, architect, 4, Broad Street Place, London, E.C.2.

Bedford.—Houses (168), London Road estate (£56,546); A. P. C. Wray, Ltd., Hertford.

Birmingham.—Factory, Hay Mills, for the Ideal Wire Mattress Co., Ltd., Birmingham.

Birtley (Co. DURHAM).—Masonic hall; F. Norman, builder, Chester-le-Street.

Bishop's Stortford.—Extensions to High school; Talbot Brown & Fisher, architects, Burysteed, Wellingborough.

Bournemouth.—Sanatorium, Longham; borough surveyor.

Brighton.—Houses (344), East Moulscombe; bor. engineer.

Broadstairs.—Houses (54), Maisonette estate, for W. C. Ward.

Bromsgrove.—Employment and telephone exchange, Recreation Road; E. Crowder, Ltd., builders, Handsworth, Birmingham.

Cannock.—Houses (40); U.D.C. surveyor.

Chester.—Extensions to City and County school, Lache school and new school, Newton, for E.C.

Chesterfield.—Houses, Killamarsh, and Eckington; R.D.C. surveyor. Central stores, Elder Way and Knifesmith Gate; Co-operative Society, Ltd. Extensions to maternity home; borough architect.

Colchester.—Houses (160), Berechurch Road; Baron Estate Co., F. C. Barrett, managing director. Aerodrome, Berechurch; borough engineer.

Coventry.—Rebuilding, Rialto Cinema, with new ballroom (electrical work); H. T. Orr. Factory, Canley, for Copper Sheets, Ltd.

Derbyshire.—Houses (40), Oxcroft, Bolsover, for C.C.; George H. Widdows, county architect, Derby.

Devonshire.—Senior schools, Torrington; director of education, Exeter.

Dorchester.—Shops and maisonettes, Trinity Street; North, Robin & Wilsdon, architects.

Dover.—Cinema, electrical work, for the Universal Cinema Theatres, Ltd.; Elgood & Hastie, architects, 10, Henrietta Street, London, W.1.

Dukinfield.—Houses (56) and flats, Birch Lane estate; C. H. Pike, builder, Hyde.

Durham.—Houses, Sherburn Hill, Sherburn and Ushaw Moor; H. G. Pescod, housing architect.

Enfield.—Houses (133), Chase Cottage estate; Geo. Wimpey & Co., Ltd.

Essex.—Senior school, Manningtree; G. C. Holland, Technical College, Colchester.

Fairlop (ESSEX).—Aerodrome (£600,000); City of London Corporation.

Felling-on-Tyne.—Houses, on five-acre site near Wellfield Terrace and Coldwell Street; U.D.C. surveyor.

Fetcham.—Houses (58), Fetcham Lodge estate; Mrs. E. E. Hartley.

Fife.—Child and maternity welfare clinics for C.C.; county clerk, Cupar, Fife.

Gateshead-on-Tyne.—Houses (34), Kyle Road, for the Church Army Housing, Ltd.; Marshall & Tweedy, architects, 129, Pilgrim Street, Newcastle-on-Tyne. Cinema, High Street (2,500 seats), for Blacks (Gateshead) Theatre, Ltd.; H. Waller, builder, Back Waller Street, Newcastle-on-Tyne. Clinic, to the Sheriff Hill Hospital; F. H. Patterson, borough engineer, Town Hall. R.C. Public Elementary School, Old Ford; Pascal J. Stienlet, architect, 5, Saville Chambers, Newcastle-on-Tyne.

Gillingham (KENT).—Cinema, Gardiner Street, for the Embassy Cinema Co. Houses (24), Allison Avenue, for A. E. Clifford & Co.

Glasgow.—Extensions to Knightswood transport depot; city engineer. Extensions to works, Polmadie Road; Acme Tea Chest Co., Ltd.

Hampshire.—Schools, Alton, and Millbrook, for County E.C.

Hanley.—Houses (170), near Cobridge Road; Salt & Trice.

Hebburn-on-Tyne.—Additions to works of A. Reyrolle & Co., Ltd.; Cackett, Burns Dick and McKellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Hendon.—Houses (28), Cool Oak Lane and Grants Close; A. Gorbing, architect, 24, Clissbury Ring South, London, N.12.

Hereford.—Factory, Marlbrook, for Cadbury, Bros., Ltd., Bournville, Birmingham.

Hetton-le-Hole (Co. DURHAM).—Houses (80); U.D.C. surveyor.

High Wycombe.—Houses (47); Webster & Cannon, Aylesbury, and F. Chandler, Long Marston, builders.

Huddersfield.—Houses (226), Roger Lane estate, Ashing Hirst; borough engineer. Maternity hospital, Fleminghouse Lane, Waterloo; Thos. Worthington & Sons, architects, Manchester.

Inverness.—Cinema for the Associated British Picture Corporation, Ltd., Film House, Wardour Street, London, W.1; the manager.

Irish Free State.—(DUBLIN).—Houses (275), Crumlin housing area; H. G. Simms, housing architect, 3, Parliament Street, Dublin. (GALWAY).—Electrical installation to the nurses' home, Central Hospital; J. P. Tierney & Co., consulting engineers, 44, Kildare Street, Dublin.

Kendal.—Houses (114); Lloyd & Cross, Ltd., builders, Birkenhead.

Kilmarnock.—Houses (350); burgh surveyor.

Lanchester.—Nurses' home and porters' lodge, Langley Park Hospital, for the Joint Hospital Board; E. Simpkin, surveyor, Council Offices, Lanchester.

Leeds.—School, near Nursery Road; city architect.

Liverpool.—Combined welfare centre, Formosa Drive, Fazakerley; land steward and surveyor.

London.—(W.C.2).—News-reel cinema, Grand Buildings; Cecil Masey, architect, 15, Caroline Street, London, W.C.1. (HIGHBURY).—Double deck stand on the ground of Arsenal Football Club (£100,000), with electrical work; Wilson Lovatt & Son, Ltd., builders, Wolverhampton.

Lowestoft.—Cinema (electrical work) for the Odeon Theatres, Ltd., Cornhill House, Bennett's Hill, Birmingham; Harry W. Weedon, architect.

Macclesfield.—Factory, Pearson Street, for the Centaur Hosiery Co., Brook Street; Mr. Russell, principal.

Maidstone.—Silver Grill restaurant, Ashford Road (electrically equipped), for T. Cook.

Manchester.—Bank premises, Oldham Road, Newton Heath. Manchester, for Manchester and Salford Savings Bank, Ltd., Booth Street, Manchester; T. Scott & Co. (Manchester), Ltd., builders, Atherton Street, Manchester.

Melksham.—Dried milk factory, Shurnhold, for the Co-operative Wholesale Society, Ltd., Balloon Street, Manchester.

Morecambe.—Premises for Montague Burton, Ltd., Marine Road; N. Martin, staff architect.

Newport (MONMOUTHSHIRE).—Schools, Malpas; director of education.

Northern Ireland (BELFAST).—Aircraft factory, adjoining Queen's Island works, for Harland & Wolff, Ltd.

North Shields.—Cinema, Billy Mill; E. M. Lawson, architect. Barrass Buildings, Barrass Bridge, Newcastle-on-Tyne.

Oldbury.—Houses (212), Whiteheath; borough surveyor.

Oldham.—Houses (41), Cobden Street, &c., for Herbert Partington & Sons.

Paignton.—Houses (75), Dartmouth Road; T. Mitchell.

Perth.—Houses (243), Crieff Road; T. M. Laren, burgh surveyor, City Chambers, Perth.

Portsmouth.—Cinema (electrical work), London Road, North End, for Odeon Theatres, Ltd.; Cornhill House, Bennett's Hill, Birmingham.

Queen's Ferry.—Cinema, Station Rd.; Deeside Enterprise Co.

Rawtenstall.—Houses, Harr Carr and Edgeside; borough engineer. Cinema, Bacup Road; United Cinemas, Ltd.

Richmond.—Enlargement of hospital (£96,650), for the South Middlesex and Richmond Joint Board.

Ripon.—Houses, Quarry estate (£25,042); Ball, Thomas & Lister, Ltd.

Rothesay.—Pier buildings; M. P. Smith, architect, Dumfries.

St. Andrew's (FIFESHIRE).—Houses (120); J C. Cunningham, 10, Alexandra Place, St. Andrew's.

Salford.—Cinema, Broad Street, Pendleton, for G. H. Munro, estate agent, 22, St. Mary's Gate, Manchester; Frank Haslam, Ltd., builders, 4, Regent Terrace, Doncaster.

Sawbridgeworth.—Houses (72), Upper Bull Fields; K. Steen, U.D.C. surveyor.

Sheffield.—Theatre (£100,000); Geo. E. Tonge, architect, Southport.

Southampton.—Cinema, Bitterne (electrical work); T. F. Ford, architect.

South Shields.—Houses (200) for Col. R. Chapman; G. R. Smith and Partners, architects, 63, King Street, South Shields. Library, Marsden Road; borough engineer; school centre, Prince Edward Road; Howard Hill, architect.

Stoke-on-Trent.—Houses, Leek Road, Hanley (£52,600); chief architect. Five-storey building, Newcastle Road, Hanley, for Twyford's, Ltd., Cliff Vale Potteries; S. Heath & Son, builders, Brunswick Street, Newcastle, Staffordshire. Shop premises, Sandyford, Goldenhill, for the Burslem and District Co-operative Society, Ltd.; Watkins & Maddox, architects, National Provincial Bank Chambers, Burslem.

Stonehouse (GLOUCESTERSHIRE).—Houses (50), Woodcock Lane; W. H. Beard & Son.

Sunderland.—Houses (58), Fulwell Road; W. Leech, builder. Coutts Road, Newcastle-on-Tyne. Workshop, stores and offices. Silksworth Lane, for H. Lambert; F. Carrell, architect, Blandford Street, Sunderland.

Surrey.—Extensions to St. Anne's Institution, Redhill (£11,150), for the P.A.C.; clerk, Kingston-on-Thames.

Swansea.—Houses (124), Trewyddfa Common; borough architect.

Swindon.—Three schools for E.C.

Taunton.—Houses (55), for Housing Committee.

Tipton.—Houses (73), Alexandra Road; C. B. Gallie, architect, Municipal Buildings, Sedgley Road West.

Trowbridge.—Houses (112) and bungalows; G. W. J. Clark, U.D.C. surveyor.

Uppingham.—Cinema, Ayston Road, for B. J. Wilson, Higher Uppingham; Draycott & Stimson, builders, Barleythorpe Road, Oakham.

Wallsend-on-Tyne.—Houses (58), King's Road, estate; Wm. Leech. Houses (206), Westmoreland estate (£55,872); L. W. Evans & Co., Sunderland.

Walsall.—Houses (132), Ryecroft and Coapool estates (£35,000); Henry Lloyd. School, Pargeter Street, for E.C.

West Bromwich.—Houses (60), near Leeswood Road, Aldridge; West Bromwich Property and Investment Co., Ltd.

Whitby.—Houses, Staithes; R.D.C., surveyor. Hospital (£23,429), for the Isolation Hospital Joint Committee; Harold Davies, architect.

Wolverhampton.—Houses (21), Chetwynd Street; F. H. Farrer. Houses (28), Linton Road; Provincial Developments, Ltd. Houses (60), Oxley Manor estate; Brookes & Edwards. Extensions to works, Upper Villiers Street; Sunbeam Commercial Vehicles, Ltd.

Workington.—X-ray and massage block at infirmary; H. Oldfield, architect, 1, John Street.